# NATURE

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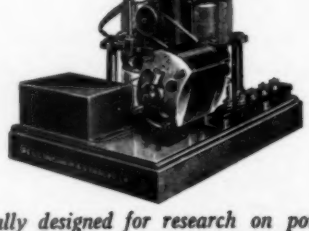

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# An African Bureau

THE African Survey, for which Lord Hailey has been responsible, derives no small share of its value from the comprehensive way in which it brings together in readily accessible form information that previously was extremely scattered and difficult to collect. On this ground alone, apart from its critical suggestions, the Survey is of immense value to all those concerned with African problems whether in the administrative or economic sphere, in scientific work or in philanthropic or missionary enterprise.

The very magnitude of the survey made, however, with its masses of data, emphasizes the point so strongly stressed in the Survey, that, in contrast with India, where information on such subjects is usually readily accessible, it is very difficult to obtain information on matters which are essential to an understanding of conditions in Africa. This difficulty is experienced fairly widely, though to an extent differing in various fields, and being perhaps more conspicuous in regard to political, economic or social developments than in the scientific field. Here, of course, the bulletins issued by the Imperial Agricultural Bureaux and the periodicals and reports issued by the medical and other research institutions in Great Britain, circulate full information on the progress of scientific investigations in a wide field.

Even these publications, however, do not usually distinguish the matters which specially concern Africa and are scarcely to be found collected in any one institution. This difficulty is much greater in the other fields. The Institut Colonial International issues from Brussels publications which are a valuable source for the documentation of the legislative and similar proceedings of colonial Governments, and its periodical sessions have yielded a useful series of discussions on different problems in administration. There are also a number of journals devoted exclusively to social, linguistic and similar studies of Africa, such as *Africa*, the journal of the Royal African Society, or *Congo* and certain journals are published locally in the African colonies. In addition to this periodical literature, there is a growing mass of general literature on Africa as well as of studies of special problems. Those sources of information are all, however, very scattered, and sometimes, as in certain French and Portuguese territories, are difficult of access. The compilation of a comprehensive bibliography, let alone the examination of source material, on many African problems is apt to be extremely laborious and expensive.

None of the available sources of information on Africa is open to the public. All are circumscribed by other purposes and in none of them are African problems considered as the major interest. Moreover, the difficulty of obtaining material is frequently accompanied by difficulty in judging its real bearing or value. Where, as in Europe or the Dominions, public measures are fully discussed in the Press or in a representative legislature, the observer is able to consider facts or statistics in relation to the policy which gives them their significance. This advantage is seldom enjoyed by observers of African colonial administrations, where policy is frequently decided in proceedings which are not made available to the public.

As regards the applied sciences, as already indicated, a wealth of material is available to the student in the scientific periodicals which the various abstract periodicals of the Imperial

Bureaux assist in rendering available. Here the difficulty lies rather in providing means by which the non-technical inquirer or the administrator can inform himself of the value of the work which is being discussed and its bearing on the practical problems with which he may have to deal. The success of a modern Colonial administration depends largely on the use which it makes of its technical departments, and accordingly any agency which keeps the administrator in touch with the contributions made by science to the solution of his problems is of value.

These are the reasons which led to the second main recommendation of the Survey—the provision of some effective means for making knowledge of Africa more accessible, not only to the public but also to those interested in the special study of African questions. To this end is advised the institution of an African Bureau, preferably situated in London, and designed on lines which would make it not only a source of information on practically every aspect of activity in Africa, but also a convenient body to maintain close contact with institutions and voluntary organizations in Great Britain and other countries interested in African development. The Bureau should be constituted so as to be capable of providing guidance to those who seek to pursue a special study in any subject of interest in Africa, or of placing them in touch with those who are competent to do so.

The scheme contemplates the appointment of a director who should himself have some experience of the requirements of social or scientific investigation. He should have as assistants, three specialists, acquainted with African conditions, and with knowledge, respectively, of scientific, economic and social (including administrative) subjects. They would publish periodically a survey of contributions to the knowledge of Africa and of events which affect workers in any branch of study. Their main contribution would not be the result of any original study; they would be dealing with information, much of which would be recorded in some form or another elsewhere.

In regard to the assembling of material, a nucleus already exists in the offices of the African Research Survey, consisting of the more important Government reports and a library of important books on Africa. This material, as well as a large number of leaflets and memoranda specially prepared for the Survey, is already classified and filed under appropriate headings, and some of it would be difficult to obtain elsewhere.

Experience must decide how far the Bureau should proceed in assembling a library of literature on African subjects. Particularly in regard to the earlier publications, it may prove unnecessary to duplicate in the library of the Bureau some of the material on Africa already to be found in the libraries of the Colonial Office, South Africa House, the Royal African Society and the Royal Empire Society. It would indeed be of advantage to avoid amassing material unlikely to be used by those concerned with the present-day development of Africa. Equally, of course, this material will frequently require supplementing on the foreign side, and it will also be essential, in regard to scientific and technical subjects, that the staff of the Bureau should acquire a working knowledge of the information available in the libraries of the different scientific institutions and of the additions which scientific research is making to it.

On this side of the work of the Bureau, an organization such as the Association of Special Libraries and Information Bureaux may well be able to render signal service in the initial stages. Some of the most important aspects of the work of the Bureau will, however, be the establishment of contacts, particularly with such institutions in Great Britain as the International Institute of African Languages and Culture or the Royal African Society. It may even be possible to establish a common library and to group these three particular institutions in the same building. Overseas contacts, however, are equally important, whether with the "Bureau Internationale de Renseignments" of the Institut Colonial International of Brussels or with official and non-official circles responsible for developments in the Union of South Africa, for example.

The Survey estimates that the proposal for an African Bureau involves an initial expenditure of about £10,000 a year, including the renting of suitable accommodation, though this expenditure would probably increase as the work developed. While it is hoped that the Bureau would receive full support from the British Government, the desirability of control by a non-official body which would be in a position to seek assistance also from Colonial Governments and from other sources is emphasized. The scheme visualizes control by a managing committee, including representatives nominated by the Colonial Office, the Union of South Africa and Southern Rhodesia, the International Institute of African Languages and the Royal African Society. If the proposal is adopted,

this committee might well be extended, by co-option or otherwise, to include representatives from different branches of science, the International Missionary Council and the like.

The organization of a clearing-house of information on these lines should directly assist the application on a much greater scale of existing scientific knowledge in the service of African needs and the solution of African problems at what the Survey describes as the most critical and formative period of African history. Equally it should stimulate further research, particularly the more comprehensive study of the factors determining the nature of its social development and a more scientific approach to the problems of health and material well-being to which the physical characteristics of the natives of Africa have given rise.

On both these grounds, the project claims the interest and support of all scientific workers, and particularly at a time when constructive development on such lines may well hold the key to the solution of the more threatening aspect of the problem of Colonies themselves.

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# The Science of Slang

**A Dictionary of Slang and Unconventional English:**
Slang, including the Language of the Underworld, Colloquialisms and Catch-phrases, Solecisms and Catachreses, Nicknames, Vulgarisms, and such Americanisms as have been naturalized. By Eric Partridge. Second edition, revised and enlarged. Pp. xviii + 1051. (London: George Routledge and Sons, Ltd., 1938.) 42*s*. net.

A DICTIONARY of slang may, at first sight, seem to have no special message for readers of NATURE, but it is impossible to turn over the pages of Mr. Partridge's monumental work without realizing how many important and perplexing problems, philological, psychological and social, are raised in the pages of this dictionary. The book provides data that will be eagerly seized on by the students of many sciences.

What is slang? We have somewhere to set a term to definition, and it may be assumed that everyone knows what is meant by standard English. Making this rather large assumption, we know also that there are deviations from the standard which are not to be classed as dialect—deviations which consist in substitutes, generally undignified, sometimes humorous, and sometimes coarse, "for those modes of expression which are employed by persons who value themselves on propriety of speech". Such substitutes are, for the most part, *slang*, and the reasons for their introduction make as difficult a scientific problem as do the philological problems involved in the derivation of the words themselves.

Over and above this, there are jargons developed by groups which desire their speech to remain cryptic—such jargons have been invented by schoolboys, by vagrants, by professional thieves, and not infrequently have in their make-up a considerable element of humour. The desire to use words or phrases which, without being cryptic or necessarily more exact in technical meaning, shall be different (and usually humorously different) from those usually employed, gives rise to the slang of certain trades and professions. A massive contribution to Mr. Partridge's dictionary accrues from terms which, in some instances originally standard English, have, for reasons not always apparent, become coarsened and colloquial and are certainly not used to-day by that class which prides itself on propriety and refinement in speech. Many such expressions possess a Rabelaisian humour and outspokenness which is something of a saving grace; many are frankly coarse *ab initio* and have never appeared in standard English. In dealing with this last-named class of unpleasant terms, Mr. Partridge is at pains to assure us that his method has been to handle them "as briefly, as astringently, as aseptically as was consistent with clarity and adequacy". He is, in short, in this matter, a consistent disciple of his great predecessor, Captain Grose. None of these categories has been neglected by Mr. Partridge. Johnson could say, speaking of the technical terms of various arts and crafts:

"I could not visit caverns to learn the miner's language, nor take a voyage to perfect my skill in the dialect of navigation, nor visit the warehouses of merchants and shops of artificers to gain the names of wares, tools and operations, of which no mention is found in books; what favourable accident or easy inquiry brought within my reach, has not been neglected; but it had been a hopeless labour to glean up words by courting living information, and contesting with the sullenness of one, and the roughness of another."

Mr. Partridge, more fortunate in the accessibility of his sources than was Johnson, has covered a very wide field. His dictionary is enriched, not only with many and varied examples of military, naval and sporting slang, but also with the jargon of the printing and other trades.

Of the varieties of slang and of cant which go to make up the dictionary, some possess much greater interest and freshness than others; great interest, for example, is attached to the *back slang* so prevalent in the coster class during the nineteenth century—a jargon in which the constituent words were produced by pronouncing the more important words in a phrase *backwards*. A skilled exponent of the art could reverse a word rapidly in a most remarkable fashion, and would not have a moment's hesitation in giving, say, "summa-toppopy" as the back slang for "hippopotamus", sometimes making the interpretation more difficult by giving the word a humorous twist "like a tol-de-rol, sir, at the end of a chorus". Back slang has given at least one word to colloquial English. "Kool the silop", the cant phrase for "look (out for) the police", obviously provides a well-known and still extant term for 'policeman'.

Rhyming slang, which has had a considerable vogue among Thespians and others, offers some curious problems to the psychologist. It is not an easy matter to place the mentality which—apart from the desire to produce a cryptic mode of speech—finds pleasure in such unmeaning rhyming substitutions as "German flutes" for "boots", "Rory o'More" for "door" and the like.

Mr. Partridge carries his learning lightly, so lightly, indeed, as to refer to Browning's famous unintentional misuse of a vulgarism as "the literary world's worst brick". It is remarkable that he should omit any notice of a similar mischance at the first night of the performance of Tennyson's "Promise of May". Mr. Pett Ridge recalls the incident in a volume of reminiscences of London in the 'eighties and 'nineties.

It is difficult to avoid superlatives in describing Mr. Partridge's massive contribution to lexicography—he has, single-handed, accomplished a feat of scholarship which it seems almost impertinent to criticize. We find, in this dictionary, at a rough estimate, some forty thousand entries of slang, colloquialisms, solecisms, nicknames, cant and vulgarisms, accompanied, where possible, with etymological notes, dictionary definitions, indications of the period in which a term was commonly in use, indications showing whether it is obsolete or obsolescent, and symbols such as +1847, meaning "in significant first use then, but still extant" and —1847, meaning "known to exist then, and presumably used some years earlier". In these matters uniformity of practice is of considerable importance, and it does seem rather unfortunate that, in the use of the negative sign, Mr. Partridge should not have subscribed to the usage of the Oxford Dictionary in which "the latest limit of an obsolete word or sense is shown by means of the year preceded by a dash, as —1759".

It would convey a completely erroneous impression were one to devote a disproportionate amount of space to the few omissions and inaccuracies which have caught the eye of the reviewer, but there are one or two points which Mr. Partridge may see fit to consider when a third edition of the dictionary is contemplated.

The entry "gas and gaiters" carries the definition "nonsense; . . . exaggerated rubbish; from *ca.* 1928". Is it possible that Mr. Partridge has forgotten the existence of the old gentleman in small-clothes and of his advances to Mrs. Nickleby? "My love, my life, my bride, my peerless beauty! She is come at last—at last—and all is gas and gaiters!" Equally surprising, too, is it to find a "modest quencher" defined as a "small drink" and dated *ca.* 1860. The immortal phrase is Mr. Richard Swiveller's, and the modest quencher is anything but modest. Even if Dickens is dated nowadays, that generation has lost much which has never repeated and relished:

"I go. Untaught and feeble is my pen,
But on one statement I may safely venture:
That few of our most highly gifted men
Have more appreciation of the trencher.
I go. One pound of British beef, and then
What Mr. Swiveller called a 'modest quencher';
That, home-returning, I may 'soothly say'
'Fate cannot touch me; I have dined to-day.'"

Turning to less literary slang, we find the dictionary defining "fixed bayonets" as a brand of Bermuda rum and dating the term as late nineteenth - early twentieth century. This may very well be, but the late Nathaniel Gubbins, who had an intimate knowledge of mid-nineteenth century Indian military slang, had no doubts about it. The term then referred to an awe-provoking dish of chicken stewed in rum.

In dating the phrase "I don't think" as 1837 and in giving a reference to Pickwick, Mr. Partridge follows the lead of the O.E.D. I find, however, that the phrase "You're a nice man, I don't think" occurs in Moncrieff's operatic extravaganza "Tom and Jerry", a dramatization of Pierce Egan's "Life in London", which was staged in November 1821. It would seem, then, that we can antedate the account given for the first appearance of this phrase by some fifteen or sixteen years.

References to music-hall and other songs are very often helpful in dating a catch-phrase, and might be recorded more often than they are. 'By Jingo', 'twiggy-vous', 'not for Joseph' and 'Jim Crow' are relevant instances.

The article *s.v.* 'non me' elucidates the phrase by a reference to Queen Caroline's trial "whereat the Italian witnesses said *non mi ricordo* (I don't remember) to every important question". The reports of the trial put this phrase constantly on the lips of one witness only, Theodore Majocci, who was flustered by Brougham's cross-examination. The point is a minute one, but dictionaries and dictionary-makers specialize in such matters.

The editor's learned note on "all my eye and Betty Martin" might well be enriched by de Morgan's adaptation of the phrase ("all ocular and Elizabethan"); the delightful military slang of "guessing-stick" for "slide-rule" is overlooked; and Mr. Justice Hawkins appears under a novel title and name as "Judge Sir Frederic Hawkins."

These are, however, trivialities; and no one can use extensively Mr. Partridge's work without feeling that it is in the ranks of the great books. It naturally owes much to its predecessors, but much has been added, and many errors corrected. Its genial scholarship classes it with Grose. It supplants Farmer and Henley, and the philologist, psychologist and sociologist will find in it an inexhaustible quarry of raw material.

ALAN FERGUSON.

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# A Catalogue of the Steroids

The Chemistry of the Sterids
By Harry Sobotka. Pp. xiii+634. (London: Baillière, Tindall and Cox, 1938.) 38*s*.

THE effort directed towards steroid chemistry in all its guises since, and as a consequence of, the introduction of the Rosenheim-King formula in 1932, has led to a rapid multiplication of the steroids, so much so that there are now described in the literature nearly five thousand interrelated derivatives of *cyclo*pentenophenanthrene. The main purpose of "The Chemistry of the Sterids" is to present a systematic classification of the more important of these derivatives recorded before January 1, 1937, together with their physical constants and references to the original literature. The classification is extremely successful, for by the introduction of an ingenious system of arrangement based upon the number of ethenoid linkages, hydroxyl, carbonyl and carboxyl groups, the matter has been rendered easily accessible. In presenting this catalogue the author has considerably lightened the task of approach to the steroid literature.

The catalogue occupies nearly five hundred pages, the first part of the book (161 pages) being devoted to a descriptive account of steroid chemistry. The early chapters deal with history, methods and results of structural investigation. A very welcome chapter is concerned with choleic acids and other molecular compounds of steroids. Another on steric considerations has the unavoidable disadvantage, common to reviews of rapidly moving and incomplete fields of endeavour, that several important memoirs have appeared since the manuscript was completed. A chapter on physical properties gives a summary of crystallographic data and a table of ultra-violet absorption spectra. It is rather unfortunate that in this table only the maxima and not the corresponding intensities are quoted. The book concludes with a collection of some four hundred formulæ which serves as a companion to the catalogue and to the text, and to which reference is freely made in both. Various errors which have been detected in proof reading have not been adjusted in the diagrams, but are carefully recorded in the legends.

The general impression gained by a perusal of this text is that a task, characterized by its multiplicity of detail, has been faithfully accomplished, that here is a text which will be welcomed by those directly concerned with steroid chemistry, and will supplement the recognized catalogue of organic chemistry.

The book has given birth to the word 'sterid', which in the opinion of the reviewer is ill-advised, to say the least. According to the author, it is "meant to comprise sterols and steroids, *i.e.*, sterol-like substances." The word 'steroid' introduced by Callow and Young has been defined as a "generic name for the group of compounds comprising the sterols, bile acids, heart poisons, saponins, and sex hormones", and though this definition requires modification, the usefulness of the term was immediately recognized and adopted by most investigators. The term 'steroids' includes the sterols, so we greet 'sterid' coldly as befits '*jargonese*'; all this apart, 'sterid' is devoid of the euphony of 'steroid'.

F. S. SPRING.

# The Newer Human Morphology

## Les Types humains

Par Eugene Schreider. Première Partie : Les Types somatiques ; raciaux, morphologiques ; constitutionnels. Pp. 104 + 8 plates. 20 francs. Deuxième Partie : Les Types psychologiques ; tempéraments ; caractères ; types d'orientation générale de l'esprit ; types psychanalytiques ; types réflexologiques ; types psychosociologiques. Pp. 79. 18 francs. Troisième Partie : Les Types somatopsychiques ; variétés neurovégétatives ; constitutions somatopsychiques ; biotypes et variétés endocrinologiques ; types criminels. Pp. 105 + 5 plates. 20 francs. (Actualités scientifiques et industrielles, 495, 496 and 497 : Biologie du travail et biotypologie, 3, 4 and 5.) (Paris : Hermann et Cie., 1937.)

THE study of the diversities of mankind is passing through a transition time in which each worker probably sees only a part of the change that is going on and can but bear honest witness to what he sees. Measurements of populations leading to calculations of means and standard deviations and complicated by the creation of various coefficients have proved disappointing and, at times, have led to obviously incorrect results regarding relationships, besides obscuring the biological fact that persons diverse in many ways appear in a population generation after generation through direct inheritance. Descriptions, on the other hand, by means of reference to abstract types, sometimes the creation of statisticians, rather than the results of biological observation, have also proved themselves to be misleading. Yet the diversities noted by Retzius, Blumenbach and others who have followed them obviously have meaning—long heads of various kinds, short heads also of various types, with facial diversities and so on in each case remain important—and even if such characters as skin colour have a different kind of biological history, they must obviously enter into descriptive schemes.

For the moment, it seems wise on one hand to try to see what groups of characters often occur together in individuals and to study the distribution of such groups of characters ; but it is likely that diverse groups of characters are but the outward and visible indications of deep internal diversities, whether what are called constitutional or what are thought to be endocrinological. Many attempts have therefore been made to describe constitutional varieties of mankind, and critical reviews of many of these attempts are the main contents of this work, after a brief and not very interestingly compiled review of 'race' classifications has been given.

Special attention is given to the classification of the French school of constitutionalists led by Sigaud and, especially, MacAuliffe. These observers seem satisfied with simple Lamarckian interpretations of the phenomenon of adaptation, which is to them, as to many others who do not quite share their point of view, the most important fact in biology. Their classification of types, however, does not really depend upon these interpretations. It divides the French male population into respiratory, digestive, muscular and cerebral types covering respectively about 30 per cent (chiefly in the mountain areas), 14 (especially in Lorraine, Normandy and French Flanders), 47 and a variable number from 7 to 25 per cent ; but it is recognized that vast numbers cannot be put completely in one or other group. In each group there are eugenetic persons in whom the predominance of one or another of the systems is only moderate ; there are others, called irregular persons, in whom that predominance is exaggerated.

Face and body are supposed to be linked and the face is said to have an upper or cerebral, an intermediate or respiratory, and a mandibular or digestive zone. The athletic type apparently has a moderate development of all three. One cannot but suggest such difficulties as that many distinguished intellectuals are far from approaching the definition given by MacAuliffe of the cerebral type. A revised version of Kretschmer's classification divides constitutions into *leptosome*, with height and length (vertical structures) developed more than breadth (horizontal structures), *athletic*, with more balanced development, and *pyenic* types emphasizing breadth rather then height. Kretschmer's *asthenic* types are exaggerated leptosome forms, and the term displastic is used for persons with markedly exaggerated characters. Kretschmer gathers temperamental differences around the terms cyclothyme and schizothyme. The first, the extroverts of Jung, are commonest among pyenic types, according to Gourewitch and Ozeretzki. The second, the introverts of Jung, are commonest among leptosome types, but are found also among the athletic types, few of whom are found among the cyclothymes.

It is evident that MacAuliffe's digestive type and Kretschmer's pyenic cyclothyme have a good deal in common, as have the muscular and athletic types of the respective authors ; but, for the present, the schemes of classification remain quite separate. The attempts of the Italian authors,

Viola and Pende, to define constitutional types by measurement are discussed in detail and there is a considerable bibliography.

These little books are thus a useful guide to several new attempts to understand the diversities of mankind, the more useful, perhaps, because the author keeps his own preferences in the background. The new morphology is trying to penetrate into the depths of causation and to find linkages, including linkages between physical and psychical. It suffers, as work on human diversities has always suffered, from the well-nigh impossibility of establishing genetic sequences that can be adequately demonstrated. It also needs to be more careful than have been the racialists not to try to classify by subdividing in such a way as necessarily to find a niche for each individual of the sample under consideration. Further, it needs to remember that these types are perhaps really growth-tendencies and that their distinguishing features may not be purely and fully heritable. Typology in mankind is a subject on which satisfying conclusions are notoriously difficult to reach, more difficult than ever since race-prejudice involving cruel treatment of Jews and others has spread so widely.

H. J. F.

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# French Colonial Petroleum Resources

**Les ressources minérales de la France d'outremer 5: Le pétrole.** (Publications du Bureau d'études géologiques et minières coloniales.) Pp. iii+263. (Paris: Société d'Éditions géographiques, maritimes et coloniales, 1937.) 45 francs.

DURING the last few years, the Bureau d'Études géologiques et Minières coloniales has published four bulletins on French colonial mineral resources. These concern coal, iron, zinc and lead, and phosphates respectively. Now a fifth and final bulletin of the series, on petroleum, is available. The introductory chapter to this bulletin contains a description of petroleum deposits in general, with special reference to geological conditions necessary for their accumulation, migration and distribution. This is followed by a concise exposition of present-day methods of exploration to enable the reader to appreciate what has already been accomplished in this direction in French Colonies, also what still remains to be done.

Tectonically, Morocco has proved very difficult from the point of view of exploration. Nevertheless, in spite of interruptions due to frequent warfare and other misadventures, much progress has already been made and an extensive programme of research is being followed. Existence of important petroleum deposits has not yet been proved in Tunis and Algeria, but numerous surface seepages point to deep-lying pools, and there is certainly justification for continuing systematic exploration of this vast tract of unproved territory. The geology of French equatorial Africa is as simple as that of North Africa is difficult, but unfortunately the equatorial forest is an ever-present obstacle against which prospectors must battle. Exploratory work must, therefore, necessarily be slow. Nevertheless, great strides have been made during the last four years, and it is considered worth while combating physical difficulties if there is any chance of substantial petroleum deposits being discovered.

Madagascar is geologically different from any French African possessions, and cannot therefore be grouped with them. Petroleum exploration in the island is, however, so comparatively new a venture that there are few actual results to report. All that can be said at present is that a programme of exploration has been drawn up which is being followed with great pertinacity.

In Syria no systematic search was made for petroleum until well after the Great War, and even then it was only because of its proximity to Iraq that its potential importance was appreciated. In fact no real programme of investigation was adopted until 1933. Although Iraq does not belong to France, it plays an important part in supplying France with liquid fuels, and for this reason, together with its proximity to Syria, its position is reviewed in conjunction with Colonial resources proper.

As a conclusion to this bulletin, a chapter is devoted to France's present economic position in the world petroleum market, interesting details being given of consumption and imports.

A bulletin of this description is bound by its very nature rapidly to become out of date. Accordingly, so that its usefulness may be extended, the Chronique des Mines Coloniales has undertaken to supply statistics and details of geological investigations from time to time as research and mining proceed. Further, a series of short articles is to be published by the same authority as occasion arises, describing the position in the mining industry of each of the countries under French rule. In this way it is hoped to direct attention, not only to results already achieved in French Colonies, but also to possibilities of future development of natural mineral resources.

### Hints to Travellers

Eleventh edition. Vol. 2: Organization and Equipment, Scientific Observation, Health, Sickness and Injury. Edited by the Secretary with the help of many Travellers. Pp. xv+472. (London: Royal Geographical Society, 1938.) 14*s*.

THE new edition of this second volume of "Hints to Travellers" is to all intents a new book. Former editions treated of little besides medical and surgical care and hints on the scope and methods of scientific inquiry. These matters are not neglected and the sections dealing with them have been recast In addition, however, there are thirteen chapters on organization, clothing, equipment, food transport, etc., in fact on every aspect of the fitting out and management of an exploring party. This is perhaps the most valuable part of the book, for it embodies the experience of many different travellers of recent years.

Polar travel looms large, but then, as the editor says, it marks a present trend in exploration, and so must command attention. Moreover, it is in polar travel that the technique has changed most in recent years. There are many extracts from the writings of recent travellers which may appear to occupy much space in a book the bulk of which must be kept within small dimensions for the sake of the traveller. On the other hand, these extracts have been carefully chosen, and each stresses some matter of importance even if it is a detail easily overlooked. Food and food values receive much attention, and photography has a long section: even the narrative volume of the expedition, written on its return, is not ignored.

The volume is valuable in every chapter, an indispensable handbook for any traveller off the beaten track and an expression of the care and critical judgment of its editor.

### Railways To-day

By J. W. Williamson. (The Pageant of Progress Series.) Pp. 160+23 plates. (London, New York and Toronto: Oxford University Press, 1938.) 3*s*. 6*d*. net.

MR. J. W. WILLIAMSON will be known to many men of science as the former secretary of the British Scientific Instrument Research Association. He has a facile pen and also hobbies, one of which is the study of railways and their working. The opening chapter in the book under notice touches on conditions of transport in Great Britain during the sixteenth century, the development of roads in later years and eventually of the 'rail way', from which the modern railway arose early in the nineteenth century. Succeeding chapters discuss individual aspects of railway transport, such as the track, the locomotive, building and repairing rolling stock, signalling, operating traffic, traffic control, and so on, with a concluding chapter on electric traction. The book is well illustrated with plates and explanatory diagrams. To the mechanically minded boy, and also to those of his elders who still regard the railway as something more than a necessary means of transport, it will be of absorbing interest.

### The Nature of Man:

Studies in Optimistic Philosophy. By Prof. Élie Metchnikoff. The English translation edited by Sir P. Chalmers Mitchell. Revised and brought up to date by C. M. Beadnell. Pp. xviii+210. (London: Watts and Co., 1938.) 5*s*. net.

WE welcome the new edition of this lively and attractive work, of which the first translation appeared thirty-five years ago (see NATURE, 70, 394; 1904). The book has been ably revised by Rear-Admiral C. M. Beadnell, who in addition to several footnotes has added appendixes dealing with artificial insemination, blood transfusion, ages at marriage, illegitimate births in different countries, suicide, infant mortality and other matters. The work begins with a historical sketch showing that while natural philosophers in all ages have sought the foundation of morality in human nature itself and have held human nature to be good, many religious doctrines, especially Buddhism and Christianity, have depreciated the body as compared with the soul.

In the following chapters the harmonies and disharmonies first among beings inferior to man and then in the human race are discussed, special attention being paid to the disharmonies in the organization of the digestive and reproductive systems, as exemplified by the presence of rudimentary organs and disharmonies before and after marriage. The part played by science in combating disease is then considered, and the final chapters are devoted to the scientific study of old age and death, which the author maintains will probably bring about great modifications in the course of the last period of life.

### Human Powers and Their Relations

By K. W. Monsarrat. Pp. xvi+289. (Liverpool: University Press of Liverpool; London: Hodder and Stoughton, Ltd., 1938.) 10*s*. 6*d*. net.

THIS book offers an excellent example of constructive thinking in theoretical and practical philosophy. The problem of knowledge forms its central theme, and is taken as the basis of a more rational organization of human relations. Knowing is conceived as a process which produces and presents reports or ideas. The proper use of ideas leads to the conception of the world in terms of power, and not in terms of matter. The classical dualism between power and matter should not be referred to the world as such, but to a duality in the relations of the process of knowing.

Applied to social problems, these views involve the consideration of the world as composed of diverse power-items which compensate each other without fusion in assemblies or associations: the human being is thus conceived as an example of influence-assembly, which retains his freedom and individuality. Society is the combination of human beings according to the same metaphysical process. The interest of these views, as we understand them, is to be found in the conception of an idealist philosophy which preserves the relative independence of the individual. In contrast with the misguided application of idealism by totalitarian States, the vision implied in this book will be found both useful and refreshing. T. G.

# Archaic Vertebrates and Evolutionary Principles

By Prof. J. Graham Kerr, F.R.S., M.P.

RECENT attendance at the discussions of the Institut International d'Embryologie and of the British Association (Section D) has impressed on me the desirability of offering—more especially to the younger generation of researchers in zoological science—a short statement of personal experience emphasizing certain general considerations, which are in my opinion useful as affording guidance along profitable lines of investigation and at the same time warning against dangerous pitfalls. I have been, in my time, responsible for a considerable number of new facts and theories relating, on one hand, to the evolutionary history of vertebrates and on the other to the general theory of evolution. I will not burden this note with bibliographical details, but refer anyone interested to my text-books on "Vertebrate Embryology" (Macmillan, 1919) and "Evolution" (Macmillan, 1926).

I may say that in my research work I have owed much to the foundations on which I was able to build—a sound training in mathematics and physics, experience of fossil collecting among the carboniferous rocks of central Scotland, and a quite unusual training in field natural history when living among the primitive Natokoi Indians of the Gran Chaco. Indications of my early interest in field natural history will be found in my various communications printed in the *Ibis* during the nineties of last century. I allude to this preliminary training, for it may perhaps be taken as explaining, at least in part, my somewhat unfashionable attitude towards the branches of science I have mentioned—an attitude sometimes disrespectful towards the mathematical treatment of complicated biological phenomena which have not been subjected to the preliminary analysis into simple components essential to make them amenable to mathematical treatment, a somewhat critical attitude towards pronouncements of palæontologists based upon the inadequate foundations provided by a study of skeletal structures in ignorance of 'soft parts', and finally, an attitude of what may have seemed over-emphasis of the need in all evolutionary speculation of paying due regard to each one of the three factors: (1) structure (which alone provides actual *records* of evolutionary history), (2) function and (3) natural environment.

The Cambridge school of zoology, in which I received my later training, was then at an important stage of its evolution, the old school of natural history having sprouted out into a luxuriant new growth of laboratory activity under the stimulus of Balfour and Foster. Regrettably, but unavoidably, the two great branches of laboratory activity diverged as they grew: that of physiology on one hand, with Foster, Gaskell, Langley, Sherrington and the rest; and that of morphology on the other, with Balfour and his successor Sedgwick and a galaxy of colleagues of the highest distinction. The splendid zoological laboratory of to-day—an imposing memorial to the tenure of office of Prof. Stanley Gardiner—represents what, in its early days, was called, as it actually was, the morphological laboratory.

The remarkable Tripos course in zoology in those days, in addition to providing a vast amount of knowledge regarding the comparative anatomy and embryology of the main groups of the animal kingdom, exercised naturally a strong directive influence on those who passed through it. In my own case, this directive influence was affected by the recognition of two important weaknesses in the school of morphology: (1) the tendency to concentrate attention on preserved specimens, to the neglect of physiological and environmental conditioning factors, and (2) the fact that the body of observations out of which the edifice of morphological theory had been built had been gathered not from such animals as from their admittedly archaic character might be expected to yield reliable information regarding earlier evolutionary stages, but from such as happened to be easily accessible to the investigator. From this latter consideration came the determination to concentrate my life-work in research upon archaic animals in spite of the technical obstacles in the way. As my immediate interest lay in the problem of the evolution of land vertebrates or tetrapods, it was to this problem that I proceeded to devote my attention.

Of the various types of tetrapod actually surviving at the present day, and therefore available for morphological study apart from mere osteology, the most archaic seemed undoubtedly to be the urodele amphibian. Of the evolutionary stages antecedent to the tetrapods or land vertebrates, on the other hand, the most archaic surviving representatives seemed undoubtedly to be the sharks, the crossopterygian ganoids, and the lung-fish. The lampreys and hagfish I left on one side as liable to mislead owing to their adaptation to

abnormal semi-parasitic habits. As regards my own research work, I determined to concentrate upon the crossopterygians and lungfish, not because I regarded them as more primitive than the selachians, but simply because our ignorance of them—particularly of their ontogeny—was more profound. The programme which I set myself, was the investigation of the three genera *Polypterus*, *Lepidosiren* and *Protopterus*—the embryology of which in particular was then entirely unknown—in order to see to what extent they supported or contradicted the accepted canons of vertebrate morphology. I need not refer here to the carrying out of that programme or to the tragic loss to science which it involved in the premature death of that splendid naturalist John Samuel Budgett, who had taken over the *Polypterus* part of the programme.

The study of these archaic vertebrates proved a fascinating task as it provided solutions to many puzzling problems of vertebrate morphology. To take, for example, one organ system alone—the blood system :

Why does the headward end of the embryonic heart in the tetrapod assume that spiral twist which results in the common pulmonary artery of the adult amniote having a diagonal position, running forwards from right to left, across the root of the systemic aorta ?

What is the explanation of the reduction of the fifth aortic arch in the Amniota ?

Why did the main stream of blood from the hinder parts of the body in the Amniota come to be carried forward by a new vessel, the posterior vena cava, in place of the original posterior cardinal veins ?

Such are examples of morphological puzzles which found their solution in the developmental phenomena of *Lepidosiren*.

Incidentally, these investigations convinced me that real progress in the advancement of evolutionary theory is to be made through the careful investigation of particular organ systems rather than by speculation regarding the ancestral origin of particular taxonomic groups. They have also provided useful warnings as to pitfalls in the way of the morphological investigator, the non-recognition of which has frequently helped to inflict undeserved discredit on morphological science as a whole.

One of these is, strangely, forgetfulness of the elementary fact that all scientific theories are simply working hypotheses, fitting the knowledge of the moment, to be discarded or modified in immediate response to the requirements of new knowledge. The neglect of this principle has made itself conspicuous again and again. An excellent example is concerned with the mode of development of nerve fibres in the Vertebrata. The view I had been taught was that the nerve fibre, already fibrillated, grew out from the central nervous system and joined up secondarily with its end-organ, muscle-fibre or what not. Investigation of embryos of the large-celled *Lepidosiren* demonstrated that this was not the case, and that the appearances which at first sight appeared to support the accepted idea were deceptive. As it is clearly against all probability that the method of nerve development in vertebrates is not fundamentally the same throughout, it might have been expected that the alternative conclusions would have been obvious to all—either that the accepted theory was wrong, or that the observations that contradicted it were erroneous. It might have been anticipated that neurologists would have hastened to check the observations for themselves. As a matter of fact, during the twenty years or so before the preparations succumbed to the wear and tear of student demonstrations, only one single neurologist made his appearance to do so—Elliot Smith. He duly satisfied himself as to the accuracy of the observations on the motor nerve trunks of *Lepidosiren* and was good enough to check the general principle involved by extending them to a sensory trunk, the olfactory nerve.

While this experience with the nerve trunks of *Lepidosiren* exemplified well the sterilizing influence of dogma in restraining the recognition of awkward new facts, the same investigation of nerve development soon directed attention to another type of pitfall, namely, the tendency to place too implicit reliance upon one particular technique. This was provided by Harrison's basic experiment in which he showed embryonic nerve rudiments growing freely through a culture medium. The careful study of sections of embryos of *Lepidosiren* showed no reason to doubt the accuracy of Harrison's results so far as mere observation went, but on the other hand did show that in the actual body of the embryo the nerve trunk, instead of terminating in a free end, was already in continuity, as a simple protoplasmic bridge, with its end-organ, in this case a muscle cell, at an extremely early stage in development when the myotome had not yet begun to recede from the spinal cord ; and that accordingly reliance upon the experimental method without applying the check of different technique was apt to lead to erroneous conclusions.

This need of checking by the use of different technical methods, frequently impressed itself during the study of sections of embryos, when it was found necessary to check the evidence of paraffin sections by celloidin or conversely.

Still another and a peculiarly prevalent source of error lies in the tendency to base broad evolutionary generalizations upon the inadequate base

provided by the knowledge of only a single organ-system. This is illustrated in particularly flagrant manner by conclusions based on knowledge of the skeletal system. The study of histogenesis in *Lepidosiren* was instructive in emphasizing the curiously vague way in which skeletal stiffening gradually spreads through the embryonic connective tissue—in striking contrast with the well-defined units which go to build up, say, the muscular or renal system. It is well also to recall in this connexion the readiness with which skeletal tissue, such as bone, develops secondarily in the living body in response to merely mechanical factors, as is well known to surgeons in the case of the human being. It is indicated that the greatest caution must be exercised in drawing phylogenetic conclusions from skeletal facts.

In the critical frame of mind induced by such considerations, it is astonishing to note the frequency with which palæontologists have allowed themselves to base the most far-reaching evolutionary conclusions upon a basis of purely osteological fact. The suggestion that the resemblances in general form of the skull and in the dentition between a Tasmanian wolf and a member of the Canidæ indicate genetic affinity would be recognized as absurd; these striking resemblances are recognized as indicative simply of convergent adaptation to similar modes of life. Yet similar resemblances in skull structure between certain mammals and certain extinct reptiles have been taken as indicating the evolutionary origin of the group Mammalia from such reptilian ancestors. The fact of the matter is, of course, that far more complete knowledge than is at present available—not merely of the skull but of the whole skeleton—would be necessary to identify the ancestor of the Mammalia, and even should this ancestor be in the distant future identified, it will still be impossible in the absence of information as to its organs other than the skeleton—such as, for example, its heart and main blood-vessels and its reproductive arrangements—whether it can safely be regarded as falling within the boundary of the group Reptilia.

Another shortcoming which frequently invalidates the conclusions of the less thoughtful palæontologists is the failure to appreciate physiological considerations. Striking examples are seen in speculations on the phylogeny of cephalopods based entirely on shell structure and ignoring the immensely important flotation effects of the gas in the chambers of the shell.

Equally striking are the efforts still made to bolster up the Balfour theory that the pectoral and pelvic limbs of the vertebrates are persisting and enlarged portions of a once continuous structure along the side of the body. Long ago it was shown that the embryological foundation of this theory was unsound. Later on, it was shown to be not merely unsound but also erroneous. But still it survives, its supporters unmoved by the physiological considerations which make it entirely improbable. One fact alone, that in every vertebrate the muscular system is in its early stage composed of segmentally arranged myotomes, indicates clearly that the primitive mode of movement of the vertebrate was propulsion through a watery medium by waves of lateral flexure passing back from the head region, and a full appreciation of the perfection of this method of propulsion is sufficient to indicate that the evolution of a new type of motor organ in all probability had to do not with swimming but with making use of solid features in the environment to lever the body forwards. The detailed investigation of the external gills of *Polypterus*, *Lepidosiren*, *Protopterus* and urodele amphibians has disclosed the existence within the phylum Vertebrata of a type of organ which possesses the full potentiality of giving rise in the course of evolution to a purely motor organ or limb. Nevertheless, we find many palæontologists still ignoring such considerations and quite unnecessarily making use of the Balfour theory to provide interpretation for fossil fragments such as those of the ancient shark *Cladoselache*.

Another old-fashioned idea which is allowed to persist in spite of its being untenable in the light of modern knowledge is that which derives the lung of land vertebrates from the air-bladder characteristic of teleostean fish. This no doubt seemed a natural enough idea to those whose freedom of vision was effectively blinkered by the general principle that land animals have evolved out of aquatic, and who did not pause to reflect that the teleostean fishes form the terminal twigs of a branch of the Vertebrata showing the highest degree of evolution for a free swimming existence and inseparably linked with this mode of existence.

What we now know, however, of the comparative anatomy and embryology of air-bladder and lung in the archaic vertebrates leaves no escape from the startling conclusion that the air-bladder of the teleostean fish, instead of representing a condition ancestral to that of the typical lung, is to be interpreted in exactly the opposite fashion. The evidence is, in fact, convincing that the air-bladder of the teleost is the modified right lung of an air-breathing ancestor.

I should not conclude this article without again directing attention to the fact that one of these archaic vertebrates, namely, *Lepidosiren*, happens to possess a character in the relatively enormous size of its cellular and particularly nuclear structures which renders it of unusual value for the study of

histogenesis and especially gametogenesis. It was a delightful, though distracting, experience to observe for the first time the beautiful mitotic figures of *Lepidosiren* in those days when Cambridge teaching was still sceptical regarding the existence of centrosomes! The value of *Lepidosiren* material for the investigation of cell-detail is well brought out by the beautiful studies on the histogenesis of the blood by Bryce, on microgametogenesis by Agar, and on neurone relations by Ballantyne. The last-mentioned provides a typical case of new facts which, if they are really facts—and that they *are* facts, accurately described, I can personally testify—are shattering to one of the most sacred beliefs, for neurofibrils can be clearly seen to pass across the synaptic junction and plunge down into the cell-body of the next neurone.

Various ideas of a more general kind bearing on the principles of evolutionary theory have been inspired by these researches: that variability is to be regarded not as a phenomenon by itself but merely as one aspect of the general instability inherent in all living substance; that the selection of variations in a definite direction necessarily involves the selection of the *tendency* to vary in that particular direction, and therefore necessarily results in 'orthogenesis'; that the phenomenon of parasyndesis discloses the existence of an attractive force which draws *like* chromatin together, and that this, while explaining the clumping together of like chromatin at successive points in the chromosome, renders unnecessary the assumption that the material basis of heredity consists of discrete and separate units or 'genes'.

Finally, I would urge, my prolonged experience in research has served to emphasize a consideration that is too often ignored, namely, that it is not sufficient to be content with making use of newly determined facts simply as arguments for or against already existing theories. On the contrary, it is essential that from time to time there should be a stock-taking, in which the body of relevant facts as now known is examined from a detached point of view, and the endeavour made by judicial consideration to arrive at a sound conclusion as to what general formula adequately fits the knowledge of to-day.

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## Food Storage and Research

THE report of the Food Investigation Board describes the general activities of the Board and, in summary form, the scientific researches carried out by the members of the food investigation staff, under the general direction of Mr. E. Barnard, the director of food investigation.* References are given to published work, but the special purpose of the report is to record the latest progress in those investigations which have not yet reached the stage at which full publication of the results is feasible.

Sir Joseph Barcroft was appointed chairman, on the resignation of Sir Frank Smith. Mr. Blackman, Prof. Hilditch and Sir Thomas Middleton were re-appointed members of the Board. Two special reports have been published, the first by R. B. Haines, summarizing the more important data relating to the invasion of animal tissues by micro-organisms and their control (Special Report No. 45), and the second by C. H. Lea on rancidity in edible fats (Special Report No. 46).

Members of the food investigation staff paid visits to South Africa, Germany and the United States and Canada during the year. Broadly speaking, the impression which the Board has gained from the report on the American tour is that while Great Britain is in no way behindhand in research on the handling and storage of foodstuffs, the application of science in this field is not so forward here as in the United States. There, the active belief of the leading industrialists in the value of research, and their keenness to apply scientific method and knowledge in the food industry were striking; and so was their readiness to spend large sums in developing new processes and in introducing new products to the public.

Reference is made in the report to the recommendation of the committee appointed to review the scope and form of the "Index to the Literature of Food Investigation", that this publication should be continued. The Board endorsed this recommendation and decided that the "Index" should cover the whole of the field which lies between the production of foodstuffs on one hand, and nutrition on the other hand; that it should be brought up to date as quickly as possible and should be published quarterly instead of half-yearly. In pursuance of this decision, the "Index" to the literature published in 1937 has now been issued, as vol. 9, Nos. 1–4. It is hoped to complete shortly vol. 7, No. 2 and vol. 8, which will deal with the literature published during 1935 and 1936.

From time to time, the Board is asked whether food that has been stored by modern methods,

* Report of the Food Investigation Board for the year 1937. (Department of Scientific and Industrial Research.) Pp. 266+v. (London: H.M. Stationery Office, 1938.) 4s. net.

such as cold storage, gas storage or canning, is as nutritious as fresh food. The question was put to the Medical Research Council, who replied that in the present state of knowledge it is impossible to state categorically whether or not stored foods are as nutritious as fresh foods. Nor is it feasible to undertake research with the view of answering that question directly, since many years of intensive work on large groups of human beings would be necessary. Even then there would be little prospect of arriving at a definite decision, for, with further knowledge of the effects of dietary factors on nutritional processes, it would be found necessary to reconsider the results of the early years' studies in the light of fresh evidence. Nevertheless, useful information can be obtained by comparing the chemical composition of stored foods with that of fresh foods, and the general conclusion can be accepted that relatively little loss of known constituents occurs in foods stored by modern methods. Moreover, experiments on animals have shown that satisfactory nutrition can be maintained on diets composed solely of stored foods. In fact, food of good initial quality, stored by the best modern methods, is likely to be superior to similar food that, though still technically fresh, is in reality stale. Vitamin C and to a less extent vitamin $B_1$, however, are liable to be destroyed by heating.

The report of the Director of Food Investigation is divided as usual into sections dealing with the different foodstuffs and the engineering problems of food storage. Two considerable pieces of work were undertaken for the Herring Industry Board: the first dealt with the quality of kippers in relation to the quality of the fresh herrings from which they are made, and the second with the freezing and cold storage of herrings. The development of rancidity in the fat of herrings during cold storage is due to the action of certain enzymes, which are activated by common salt. Herrings frozen in brine need careful washing and glazing before storage: the possibility of satisfactory freezing in air is being explored.

Storage in ice will keep fish fresh for 10–12 days, a period which covers some two thirds of the trips made by British trawlers. Freezing in brine at −20° C. with storage at the same temperature or at −30° C. will keep white fish fresh for at least six months; lemon soles have been kept in a palatable condition for as long as two years. The fishing industry is now seriously considering the commercial possibilities of brine freezing and cold storage. It must, however, be emphasized that the fish should be absolutely fresh when frozen; it is of interest, therefore, to note that a simple chemical test for freshness, based on the estimation of volatile organic bases, appears promising. According to the report, the dimethylamine content of the fish follows the bacterial curve very closely during spoilage, although the absolute amount present is much less than that of the triamine and ammonia. (See also NATURE, Dec. 17, p. 1078.)

The increase in the hydrogen ion concentration which is essential to the proper keeping of the flesh of animals can only be ensured if an ample reserve of glycogen is present in the muscles at the moment of death. The practice of resting animals for at least twenty-four hours before slaughter is essential: it is also advisable to give a ration of easily absorbed food, such as cane sugar or glucose, rather than to withhold food completely during this period. Struggling on the slaughtering floor should also be reduced to a minimum; estimations of lactic acid in the blood of slaughtered animals which have struggled show that an appreciable loss of acid may take place from glycogenolysis in the muscles; the acid in the blood will not contribute to the rise in muscle hydrogen ion concentration.

About two fifths of the report is devoted to the storage of fruit and vegetables. The study of the respiration of the apple has brought to light a new fact of practical importance. It appears that, in the stage before the attainment of full maturity at which the fruit is often gathered, namely, just before the onset of the climacteric rise in respiration, apples exhibit, on exposure to concentrations of carbon dioxide up to 15 per cent, a temporary increase in activity which may amount to as much as 100 per cent. Hence the possibility of carbon dioxide accumulating to dangerous levels is greater in the period immediately after the fruit has been put into store, especially if warm and respiring rapidly, than had hitherto been thought possible.

Experiments have been carried out on the cooling and storage of fresh strawberries for short periods. A temperature of 38° F. was satisfactory for 2–3 days' storage, but 32° F. gave more control over fungal rotting and would probably be necessary for longer storage. The rate of cooling affected the rate of subsequent deterioration. With slow air-speeds and a high relative humidity, no perceptible damage occurred in fruit cooled with air at either 23° or 28° F., provided the fruit was not allowed to freeze. A preliminary experiment on gas storage showed that the growth of fungal rots could be retarded without damage to the fruit by an atmosphere consisting of 10 per cent carbon dioxide, 10 per cent oxygen and 80 per cent nitrogen.

Other matters which are dealt with in the report are the storage of broccoli, the preservation of pears and asparagus by freezing, the effect of various methods of manuring, the storage properties of apples, the storage of hothouse grapes and the ripening of imported pears and plums.

# The Nile Flood

By Dr. H. E. Hurst, C.M.G.

THE Nile flood of 1938 has been exceptionally high, and if we consider the Nile at Aswan, it was the highest since that of 1898 or perhaps 1892. Thanks to the protective measures carried out by the Ministry of Public Works, the water was passed through the whole length of Egypt to the sea (1,500 kilometres) without serious damage. Damage was limited to the loss of crops on islands and low lands lying inside the river banks and to infiltration, and this occurs in all years when the flood is fairly high. Among the protective measures was the use of the Aswan Reservoir to prevent the river-level passing the danger point, whereby the peak was lowered by about twenty centimetres, and the level of the river reduced during about twenty days.

The flood is produced by rainfall (not snow) on the Abyssinian Plateau, which causes the Blue Nile, Atbara and their tributaries to rise regularly each year beginning usually in May or June and reaching their maximum in August or September. The White Nile contributes, but its variation is much less than that of the Abyssinian tributaries, and it does not reach its maximum until some weeks after the peak on the Main Nile is past. This year the maximum discharge on the Blue Nile was about 730 millions of cubic metres per day on September 2 and on the River Atbara 310 millions of cubic metres per day on August 23, while the maximum on the Main Nile at Wadi Halfa was about 1,020 millions of cubic metres per day and occurred on August 31.

There is no doubt that the present flood is the highest for forty years, but an exact comparison with the high floods of last century is not easy. Previous to the present century there were few measurements of discharge and these were always made with floats, so that we cannot compare directly quantities of water which are the real measures of floods. Current meters were introduced by Sir Henry Lyons at the beginning of the present century. There are, however, records of the level on gauges which have been read regularly for the last seventy years. The difficulty with these is that changes of river bed affect their readings, so that it happens that with two floods of nearly equal maximum height one may appear higher on the first gauge and the other on the second. There is reason to suppose that even the Aswan Gauge at the foot of the first Cataract has changed relatively to other gauges since the Dam was built at the beginning of this century. However, these variations are not as a rule large, and the gauges at some sites give a fair comparison of the heights and volumes of floods.

For more than thirty years there have been gauges on the tributaries of the Nile in the Sudan, the farthest south on the Blue Nile being at Roseires near the Abyssinian frontier, and thus warning of the rise of the river is obtained about ten days before its peak reaches Aswan. A similar warning is received from a gauge station on the Atbara, but the time interval is shorter.

The frequency distribution of floods is interesting. In addition to records of the level at Aswan which cover the last seventy years, there are records from the Roda Nilometer in Cairo which go back, although with large gaps, to A.D. 622, soon after the Arab conquest of Egypt. These records have not the precision of modern observations but are probably as reliable as present-day statistics about less well-defined phenomena such as health and social conditions, and they cover a very long period of the rise and fall of the Nile. They have been analysed for periodicities by the late Prof. H. H. Turner, Mr. J. I. Craig and Dr. C. E. P. Brooks, and periods varying from 2 to 240 years have been found. The period of greatest amplitude so far is one found by Prof. Turner of 240 years, with an amplitude of 15 cm. for the maxima and 46 cm. for the minima.

RECORDS OF ASWAN GAUGE

| Description | 1869–1898 | | 1899–1938 | |
|---|---|---|---|---|
| | Height (metres) | Year | Height (metres) | Year |
| Maximum gauge reading of highest flood | 94·15 | 1878 | 93·50 (Corrected for effect of reservoir) | 1938 |
| Maximum gauge reading of lowest flood | 91·40 | 1877 | 90·11 | 1913 |
| Mean flood maximum for period | 93·26 | | 92·46 | |
| Number of years with maximum greater than 93·30 m. | 16 | | 2 | |
| Number of years with maximum less than 91·40 m. | 0 | | 2 | |

The analysis by Dr. Brooks does not extend to periods longer than 76·8 years, but he finds a number of periods of average amplitudes of the order of 10 cm. His best-defined periodicity is that of 76·8 years, with a mean amplitude of 17 cm. The average standard deviation of the flood-levels

is 56 cm., which makes apparent the relative smallness of any periodic effects, which although of theoretical interest, are of no use to the forecaster. A glance at the records when plotted on a fairly large scale shows that there is no period which is directly evident to the eye, and that the principal features are the existence of fairly long terms of years when, on the whole, the floods have been high and others when floods have been low. This fact is well illustrated by the Aswan gauge records for the period 1869–1938. By dividing this period into two parts, 1869–1898 and 1899–1938, an example is afforded of a high term of 30 years followed by a low term of 40 years, with the results shown in the preceding table.

The most striking feature of this table is that in the thirty-year high term one year in two was higher than all but one of the succeeding forty-year low term. The important question, which however we cannot answer, is, are we now entering on a term of high floods?

If flood heights are taken without regard to order, they give a frequency curve of normal form, but owing to the existence of high and low terms of years this frequency curve cannot be applied directly to give, for example, the chance of occurrence of a very high flood like that of 1878 in the next twenty years. Some work has recently been done on problems of this type which it is hoped to publish later.

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# Obituary Notices

## Prof. William McDougall, F.R.S.

WILLIAM McDOUGALL, whose death was recently announced, was partly Scottish, partly Saxon; he came partly of industrial and partly of agricultural stock; he was in part scientist and in part philosopher. One side of him was intensely interested in social movements and social activities; another was reserved, contemplative, and, to use his own word "arrogant". He was probably the most widely studied, the most universally known and appreciated of all contemporary psychologists. Yet to the end he regarded himself as an upholder of lost causes, a rebel against current conventions, a voice crying in the wilderness with but few to listen and to pay attention. In 1930, he wrote a brief, charming and frank autobiography ("History of Psychology in Autobiography", edited by Carl Murchison, Clark University Press. Vol. 1, pp. 191–223), and there, if anywhere, the paradoxes of his life and work are clarified and interpreted.

McDougall's life was a varied one. After a private school and a year at Weimar he entered the University of Manchester, and though he was at first deeply attracted by geology, he graduated in 'general science'. In 1889, he won a scholarship at St. John's College, Cambridge. At that time physiology was developing rapidly in Cambridge, and soon McDougall decided to specialize in this direction and to qualify in medicine, not in order to practise, but to fit himself more fully for original research. He took his degree with the highest honours and went to St. Thomas's Hospital, where he worked in the Physiological Laboratory, then under the direction of C. S. Sherrington. His research, partly on muscle contraction and partly on psychophysical problems, brought him a fellowship at St. John's College, but soon after this, in 1899, he joined the Cambridge Expedition to the Torres Straits, where he collaborated with W. H. R. Rivers and C. S. Myers in a comparative experimental study of native sensory reactions. He paid an extended visit to Borneo and saw something of China, Java and India before he returned to Cambridge.

For a day or two McDougall was an elected tutor of St. John's. But suddenly he flung aside one of his principles—"that a man whose chosen business in life was to develop to the utmost his intellectual powers should not marry before forty, if at all"—and married. For some time he combined a honeymoon and science at Göttingen, where he worked with G. E. Müller. Although he was somewhat out of sympathy with Müller himself, it was here that he began his experimental work on colour vision which many still think to be the best work he ever did. Characteristically he opposed Helmholtz, Hering and all his contemporaries who approved of their views. He said that he returned to Thomas Young, but it was a return with many differences. It was probably this work more than anything else which later won him his fellowship of the Royal Society.

Back in England, he taught experimental psychology for a few years at University College, London, and continued his own research on vision, on attention, and on general psychophysical problems. He also planned a book on social psychology.

In 1904, McDougall became Wilde reader in mental philosophy at Oxford, and he continued to hold this post until shortly after the Great War. He was, he says, happy enough with the Oxford people—he became in due course a fellow of Corpus Christi—but very restive and discontented with the Oxford atmosphere of those days. When the Great War came, he was for a short time a private in the French Army and for a longer time a major in the British. At the Netley Hospital he had charge of a great many nerve and 'shell shock' cases and became deeply interested in the psychological study of functional disorders of the central nervous system.

During the Oxford period he wrote his "Introduction to Social Psychology", "Body and Mind", "The Pagan Tribes of Borneo" (with Dr. Charles Hose), the small Home University text-book and finally "The Group Mind". The first of these books, he says, dropped like "a stone into a bottomless pit". If so, it has successfully bounced out again, exhausted some twenty-three large editions and vastly influenced very nearly everything that psychologists have written about the subject since.

After the War, McDougall was invited to succeed Münsterberg in the chair of psychology at Harvard. He went to the United States with high hopes, found there very many friends, but was plunged into intense public controversy which persisted to the end of his life. American behaviourism represented for him everything which he most heartily disliked. He attacked it vigorously. He continued his attacks long after the battle had, to all intents, been won. He published book after book, and the motive of them all was the same, to fight all types of 'mechanistic' explanation in every field of science and to do this in the interests of "the art and theory of the internal life of man".

Harvard did not hold him for long. In 1927, he accepted a new chair of psychology at Duke University, North Carolina, and there he remained, latterly with yearly visits to England, until his death. On the whole this suited him the best of all his many dwelling-places. The less hurried, more patriarchal atmosphere fitted well with his temperament and helped his work. His philosophical and ethical interests, always strong, became ever more pronounced. As a psychologist his primary concern was to establish a wide teleological point of view, and in so far as his experimental interests persisted, they were confined to a general approval of work on telepathy, clairvoyance and the like, and to his well-known Lamarckian experiment.

McDougall began the Lamarckian work at Harvard and continued it at Duke. He considered the question at issue "the most important question yet formulated by the mind of man and clearly susceptible of solution by experimental procedure"; and he was firmly convinced that his own long-continued work with white rats had achieved a "clear-cut and indisputable proof of the reality of Lamarckian transmission".

A few months before his death McDougall published his last book, "The Riddle of Life". He had set out, an unwearied soldier, upon his old campaign against mechanistic explanation in Nature and in life. He had conducted it with brilliance and with vigour. He was in the grip of a painful and a fatal disease. Only a "marvellous operation" enabled him to complete the work. As he read the proofs of this book it seemed to him that possibly some of his criticisms of physical and biological men of science might appear to be harsh and unsympathetic. So, himself near to death, he paid a last tribute to scientific endeavour. "I am now more than ever sensible of the splendour and achievements of modern science, and grateful to those whose skill and labour and genius have made possible such great benefits as I have received from the hands of my colleagues". He desired only that science should discard all pontifical claims and remain humble and honest in its search for truth. For himself the beginnings of the ultimate truth had been found. He saw in all forms of behaviour "some large unity or community of Nature underlying the separate individual organisms". He believed that, within every society, from insects to man, he could discern a harmony of activities "secured by the direction of some intelligent purpose more comprehensive and powerful than that of any individual member".

F. C. BARTLETT.

AN anthropological correspondent writes:

Prof. McDougall, with the late Dr. W. H. R. Rivers, was a pioneer in the application of the methods of scientific psychology to the study of peoples of backward culture in the field, when they were both members of the Cambridge Anthropological Expedition to the Torres Straits under the leadership of Dr. A. C. Haddon. One outcome of this early interest in primitive mentality was "The Pagan Tribes of Borneo", which Prof. McDougall published in 1912 in collaboration with the late Dr. (afterwards Sir) Charles Hose. This intimate and detailed study of peoples, who when first known to one of the authors were in the enjoyment of a simple culture barely touched by European influence, is still one of the most highly regarded of ethnological treatises belonging to the early part of this century. A further result of Prof. McDougall's early studies in social anthropology is to be seen in his bent towards the sociological implications of psychological studies, which is apparent throughout his published works, and is especially to be noted in the analyses of world problems, which he has produced in the years since the Great War.

## Prof. Georges Urbain

THE death on November 5 of Prof. Georges Urbain, director of the Institut de Chimie, past-president of the French Chemical Society, removes a well-known figure from French scientific life.

Born in Paris on April 12, 1872, son of a professor of chemistry, he studied at the Paris School of Physics and Chemistry and carried out research work under Friedel, Schutzenberger and Jean Perrin, obtaining his doctor's degree for investigations on the rare earths.

After five years of industrial research with the Compagnie générale d'Électricité, Urbain returned to academic life, lecturing at the School of Physics and Chemistry and later at the Faculty of Sciences of the Sorbonne, where he became professor in 1908.

The name of Urbain will always be associated with our knowledge of the rare earths. He showed that a number of so-called pure elements belonging to that series were in fact mixtures of europium, gadolinium, terbium and dysprosium. On the other hand, from ytterbium he separated a new element, lutecium (atomic number 71) and forecast the existence of a further element of atomic number 72 (celtium) which was later identified by Hevesy (hafnium.)

In pursuing the difficult investigations connected with the separation of the rare earth elements, Urbain showed great versatility in employing many physical and chemical methods, often necessitating prolonged and tedious work. It is estimated that, together with Lacombe, he had carried out some 200,000 fractional crystallizations over a period of fifteen years.

Like preceding investigators, Urbain began by studying the absorption and emission spectra of the rare earths, then went on to the magnetic properties and the phosphorescence in cathode tubes, discovering the law of optimum phosphorescence of binary systems. He also carried out many accurate atomic weight determinations.

In addition to his work on the rare earths, Urbain will be remembered for his contribution to the study of complex inorganic salts, which he considered to form a link between inorganic and organic compounds.

During his career, Urbain filled many important posts. He lectured at the École Centrale and presided over the Experimental Section of the École des Hautes Études. In the Great War he directed the Chemical and Technical Section of the Artillery.

These numerous activities none the less left Urbain time for artistic recreations. Those who attended the banquet in his honour given at the Maison de la Chimie last June were privileged to hear several of his original musical productions.

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WE regret to announce the following deaths :

Prof. Edwin H. Hall, emeritus professor of physics in Harvard University, on November 20, aged eighty-three years.

Prof. J. Šplíchal, professor of inorganic and analytical chemistry in the School of Mines, Příbram, Czechoslovakia, who had only recently completed a lengthy study of the thermal decomposition of the carbonates of calcium, magnesium, iron and manganese, on December 8, aged fifty-three years.

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# News and Views

## Society for the Protection of Science and Learning

PERHAPS there is no finer testimony to the work undertaken by the Society for the Protection of Science and Learning, the report for 1938 of which was referred to in NATURE of December 17 (p. 1051) than the extent to which it has received the active support during the whole of its five years existence of the university staffs in Great Britain. Not only have individuals and committees in the majority of academic centres lent ready assistance to their exiled colleagues from abroad in the way of advice and vigilance for new openings for them, but also they have contributed financially more than £10,000 towards the funds of the organization which seeks to aid academic refugees. The Society itself has arranged a week of meetings early next term to take place in the great majority of British academic centres, with the view of spreading information concerning the plight and prospects of academic refugees. Among those who have agreed to take part in these meetings are included : the Home Secretary, the Archbishop of York, Viscount Samuel, the Marquess of Reading, Sir William Bragg, Sir Henry Dale, Sir Richard Gregory, Sir John Hope Simpson, Sir Norman Angell, Sir Allen Mawer, Sir Bernard Pares, the Hon. Harold Nicolson, Mr. Philip Guedalla, Mr. Walter Adams, Prof. Gilbert Murray, Prof. Winifred Cullis, Prof. John Macmurray, Prof. P. M. S. Blackett, Prof. Lancelot Hogben, Prof. F. A. E. Crew, Miss Rebecca West and the Hon. V. Sackville-West. The Royal Society is giving a special reception to the academic exiles and those who have been working in their interests, in collaboration with the British Academy, on February 7 ; and on February 10 the evening discourse at the Royal Institution is to be given by Prof. Max Born, one of the most distinguished of the refugee men of science.

## The Chemical Society

AT a meeting of the Chemical Society held at the Royal Institution on December 15, it was stated that Prof. Robert Robinson, Waynflete professor of chemistry in the University of Oxford, has accepted nomination to the office of president for the period 1939–41, which includes the centenary celebrations of the Society to be held in April 1941. The Longstaff Medal for 1939 has been awarded to Prof. I. M. Heilbron, for his outstanding contributions to the science of chemistry in the field of natural products, especially vitamin A and related natural pigments, the anti-rachitic vitamin D and its precursors, and the constituents of the fish liver oils and of natural resins of the triterpene group. Prof. Heilbron was lecturer in organic chemistry in the Royal Technical College, Glasgow, from 1909 until 1914, and in 1919 became professor of organic chemistry there. In 1920, he proceeded to the University of Liverpool as professor of organic chemistry ; in 1933 he held the chair of organic chemistry in the University of Manchester. In 1938, he was appointed professor of organic chemistry at Imperial College, London.

AT the meeting of the Harrison Memorial Prize Selection Committee, consisting of the presidents of the Chemical Society, the Institute of Chemistry, the Society of Chemical Industry, and the Pharmaceutical Society, held on December 14, it was decided that the Harrison Memorial Prize for 1938 should be awarded to Mr. Alexander King. Mr. King received his chemical training at the Imperial College, South Kensington. From 1930 until 1931, he worked in the Physical Chemistry Institute of the University of Munich under Prof. K. Fajans, and from 1931 to the present date has held the post of assistant

lecturer at Imperial College. His original investigations on adsorption and on emulsions and other colloid topics form notable contributions to our knowledge of physical chemistry. After a brief statement regarding the establishment of the Faraday lectureship, the president (Prof. F. C. Donnan) introduced Dr. Irving Langmuir, who then delivered the seventeenth Faraday Lecture entitled "Monolayers on Solids". At the conclusion of the lecture he presented the Faraday Medal to Dr. Langmuir.

### Life-size Model of a Blue Whale

A MODEL of a 93-ft. Blue whale has just been completed in the Whale Hall of the British Museum (Natural History). It is constructed of plaster of Paris and cement on a wood and wire-netting framework and weighs between six and seven tons. The proportions and colour are based on photographs and written descriptions and on very numerous measurements of actual specimens. Features of interest in the model are: the great size of the head, which is nearly a fifth of the total body length; the eye just behind the angle of the mouth, and the very small ear opening a little distance behind the eye; the tapering beautifully stream-lined flippers, and the enormous tail flukes some eighteen feet from tip to tip. The numerous grooves covering the throat and chest are a typical feature of the family Balænopteridæ to which this species belongs. The Blue whale, which grows to 100 ft., is the largest of all living animals and, so far as is known, the largest that has ever existed. At birth it is more than 24 ft. in length, and by its third year of life when it becomes sexually mature it is 74–77 ft. long. Its distribution is world wide, but at the present time the only remaining important area of concentration is in the Antarctic. There it is being hunted by the whalers for the oil obtained from blubber and flesh. During the 1936–37 antarctic whaling season, out of a total of 32,821 whales slaughtered, 14,183 were Blue whales.

### A Kentish Iron Age Hill-Fort

THE hill-fort at Oldbury, near Ightham, Kent, the excavation of which was described by Mr. J. B. Ward before the Society of Antiquaries of London on December 15, is the largest hill-fort of iron age date in Britain. Its ramparts are some two miles in circumference and enclose a space of 120 acres. Originally, it would appear from the evidence of sections cut in the ramparts, the erection was a place of refuge rather than a permanent settlement. This was at the very beginning of the first century A.D.; but later the gate facing the North Downs was elaborately refortified with stone-revetted fighting platform and outworks. The associated pottery shows that this refortification was carried out in A.D. 43 at the time of the Claudian invasion. Although Oldbury lay off the line of march of the Claudian armies proceeding from East Kent, where they landed, to Colchester, the evidence of the burning of the gates and quantities of sling stones suggest that it was sacked then or soon after. The camp was not again occupied. No Belgic pottery was found in the original fortification, but only in the later works. From this Mr. Ward infers that the original fortifications were erected by another people who had established themselves in the Wealden areas of Kent, Surrey and Sussex, working the local supplies of iron, and that its original purpose must have been to serve as a protection against the inroads of the Belgic tribes, whose headquarters lay north of the Thames. The occurrence of Belgic pottery in the later fortifications suggests that by that time the Belgic people had taken possession of the fort.

### Mesolithic Dwellings at Farnham, Surrey

EXHIBITS illustrating the culture of the inhabitants of mesolithic pit-dwellings at Farnham, Surrey, are now on view in the Prehistoric Galleries of the British Museum (Bloomsbury). These dwellings, on a site which is the only one of its kind as yet found in Britain, have been excavated by Dr. and Mrs. Grahame Clark. The results of the excavation, which has occupied two seasons, were described by Dr. Clark at a recent meeting of the Prehistoric Society. The site of the settlement, which is the property of the Farnham Urban District Council, consists of a number of irregularly shaped pits, three feet deep in places, which have been scraped out of the gravel of the old Blackwater River. These pits represent the chief habitations of a mesolithic people, who probably spent their summers hunting on the Lower Greensand, when they lived in temporary shelters. Four huts have been excavated. In one pit there was a hearth and near another there were signs of a post, which probably had supported some light framework arranged tent-wise. Generally, however, the roofing seems to have been of the nature of a lean-to. Large numbers of microlithic implements were discovered, with flint axes, scrapers and waste flint cores and flakes. Altogether, between forty and fifty thousand worked flints have been discovered, and fifteen thousand flints cracked by fire have been found. These houses are, as stated, the first of their kind to be found in Britain; and they probably represent the first type of habitation in use in Britain other than the cave. They are considered to date from about 3000 B.C., and support the contention that artificially constructed dwellings are more ancient than has been thought. On the Continent, evidence is accumulating that mesolithic man was nomadic, inhabiting light shelters in the summer, and more or less permanent dwellings, usually of the pit-dwelling type, in the winter. The exhibits now shown in the British Museum are drawn from two of the dwellings excavated, and include a large and representative selection of the implements found.

### Accessions to the British Museum (Bloomsbury)

INTERESTING additions to the collections of British antiquities of the British Museum (Bloomsbury) were announced at the December meeting of the Trustees. Among these the most important is an iron sword of the second century B.C., with its bronze scabbard mount, which has been lent for temporary exhibition by the Duke of Northumberland. It was found in the River Witham below Lincoln in 1826, probably at the same time as the famous bronze shield of the

iron age, which, with its characteristic Celtic ornament combining the use of metal and enamel, has long been one of the Museum's most striking exhibits among British antiquities. The decoration of the scabbard mount is an example of the earliest Celtic art of Britain, and shows the La Tène curvilinear style of ornamentation in the form in which it reached Britain. Other accessions, also of great interest, come from a round barrow at Riffley Wood, near King's Lynn, which has been excavated by Mr. I. J. Thatcher and Mr. P. L. K. Schwabe. Among these are a segmented bead and a ring pendant of bluish-green faience, which were associated with nine or ten cremated urn burials of the Middle Bronze Age found on top of the mound. They belong to a class of ornament which has been found in bronze age burials in Britain and on the Continent; and they agree in all respects with examples found at Tell el-Amarna in Egypt, dating from about 1400 B.C. The grave pit of the mound below the level at which the urn burials were found, contained no remains; but the whole of the surface-level below the barrow was covered with pottery fragments, representing hundreds of vessels. These sherds were of beaker pottery of the Early Bronze Age, of the approximate dating of 1800 B.C. It seems clear that this was not a habitation site, and the sherds are thought to be either the debris of the floor of the dead man's hut, which was brought here entire, or, perhaps more probably, the result of a ritual, which involved the scattering of a large number of potsherds.

### The Iron Industry in South Yorkshire

BEFORE the introduction of mild steel about sixty years ago, engineers had to rely on wrought iron made by the puddling process introduced by Henry Cort in 1783. Among the various brands of wrought iron none was superior to those made in Yorkshire. But long before Cort's time iron was made in Yorkshire, and in a paper entitled "The South Yorkshire Iron Industry 1698–1759", read to the Newcomen Society on December 14, Dr. A. Raistrick gave an account of the operations carried out in the Sheffield–Leeds–Huddersfield area about two hundred years ago. The source of his information was manuscripts discovered a few years ago, and now preserved by the Bradford City Museums and Library Committee, relating to the activities of the various branches of the Spencer family, all Quakers. The documents give accounts of 10 furnaces, 14 forges and 5 slitting mills, and though much of the information relates to the business side of the industry, they embody a considerable amount of technical information about the mining of the iron ore, the construction and working of the furnaces and forges and the production of charcoal. The main group of furnaces was on the outcrop of the Tankersley Ironstone and near streams which were used for driving water-wheels for working the bellows. As in Sussex, a determining factor of the industry was the supply of charcoal, and it was rarely possible for a furnace to be worked for more than half the year. The manuscripts, as Dr. Raistrick said, put a new complexion on the story of the iron industry in the area.

### British Coal Utilisation Research Association

ON December 14, the British Coal Utilisation Research Association held its first ordinary general meeting under the presidency of Sir Evan Williams. It was founded in April last, having incorporated the Research Department of the Combustion Appliance Makers Association (Solid Fuel) and with a membership covering all sections of the industries of coal and its appliance manufacturers. Its income from these sources and Government grant is guaranteed at £29,000 for five years. Premises near West Brompton Station have been secured and are being adapted to the purposes of an experimental station. It was stated that fruitful work has already been done in both the domestic and the industrial sections. In the former this has been concerned with the open fire, and the use of natural smokeless fuels and smoke reduction. In this connexion it is claimed that success has been achieved in the design of solid fuel cookers to replace in railway restaurant cars those fired with oil gas. On the industrial side, the supply and use of solid fuel for small industry, pulverized fuel, and industrial temperature measurement have engaged attention. A special committee has been set up to study the question of producer gas transport and supplement the work already in progress at the Fuel Research Station. It has long been a matter of reproach against the coal industry that it has shown complete indifference to the rational and efficient utilization of its commercial product. The launching of this Association will remove this reproach, and, as the president said, it will be "the missing member of a team which will work in harmony to bring about a more perfect knowledge of the properties of coal measures and advances in their fuller and better utilization".

### Blind Landing System for Royal Air Force Equipment

THE Air Ministry has announced its intention to equip all R.A.F. bombers and reconnaissance aircraft with the Lorenz blind approach system. If experiments during this winter prove this to be successful, the fighter class of aircraft will then also be so equipped. This follows the announcement that forty R.A.F. aerodromes would have the radio transmitting apparatus for this system installed, as mentioned in NATURE of November 26. The apparatus to be carried in each machine weighs 50 lb. and costs about £200. Its manipulation demands a certain technique, and pilots need considerable practice before being able to use it in addition to the other movements and observations that are incidental to the operation of landing a modern high-speed aeroplane. A special 'Link' trainer is used for practice in the use of the Lorenz system, upon which approaches and landings can be simulated without leaving the ground. These are to be provided at R.A.F. flying schools, in addition to which each service station will carry one. The training of the personnel will be undertaken by special instructors, who will have already attended courses at the Central Flying School at Upavon, Wilts.

### Wedgwood's Portrait Medallions of Men of Science

IN his Friday evening discourse before the Royal Institution on December 16, Dr. John Thomas spoke on "Josiah Wedgwood and his Portraits of Eighteenth Century Men of Science". The great success of three fellows of the Royal Society—Josiah Wedgwood and his two friends Matthew Boulton and James Watt—as industrialists was discussed. The successful production of artistic pottery at Etruria and of steam engines at Soho Factory, was only possible because of the persistent application of scientific principles. These 'philosophic' fellow-manufacturers endeavoured to satisfy this craving for scientific knowledge by attaching themselves to (*a*) the Lunar Society in the Midlands and (*b*) the Royal Society of London. Josiah Wedgwood, because of the artistic character of his jasper portrait medallions in the days before photography, established himself practically as the 'official' portrait producer of learned societies. Proof of this is the assembly of more than one hundred portrait medallions in Dr. Thomas's collection. Wedgwood handed the torch of science to his descendants, among whom was the illustrious Charles Darwin, his grandson, of whom Dr. Thomas exhibited a fine plaque by Wedgwood. Thus we, who live in the twentieth century, owe a great debt of gratitude to the 'prince of potters', not only for his scientific outlook, but also for the light which he has shed on his scientific contemporaries, through his inimitable portrait medallions.

### Earthquake in Spain

AN earthquake was experienced in Spain on December 13, shaking the whole province of Valencia. The shock, which lasted three seconds, caused some apprehension and damaged buildings, but no casualties are reported. The district concerned is to some extent seismically active, as it borders the well-established Mediterranean region of earthquake activity, though it is not so densely populated with epicentres as is the region of Andalusia and Granada to the south of it. No really great earthquake has been experienced nearer to this region than Lisbon, 475 miles distant. It was from the Lisbon epicentre that the three shocks and several aftershocks occurred on and after November 1, 1755, at 9 h. 40 m. local time. The first lasted seven minutes, destroyed Lisbon and caused remarkable sea-waves in such distant regions as Scotland and Sweden. The second at 10 h. engulfed the Cays Depreda with the people on it and the vessels near it so that none of them were seen again, and altogether upwards of fifty thousand people lost their lives on that occasion.

### New Merseyside Nature Society

FOLLOWING an inaugural field-meeting at Freshfield dunes and shore on December 11, a new nature study society for south-west Lancashire and Wirral was launched, as the Merseyside Branch of the British Empire Naturalists' Association, when the following officials were elected for 1939: *Hon. President*, J. W. Nixon (who is the Ribble Valley representative of the B.E.N.A. and honorary secretary of the Blackburn Naturalists' Field Club); *Chairman*, J. C. Miller, of the University of Liverpool; *Hon. Organizing Secretary*, Eric Hardy. It was announced that the new Merseyside Naturalists' Association would cover the area between the Ribble and the Dee on a much more modern and active method of general field nature study than was at present available in the area, although it was in no way antagonistic to some ten older natural history societies in the district. Mr. Hardy stated that the Society had been formed by about fifty naturalists and nature-lovers who had given their signatures to the desire for introducing the B.E.N.A. work to Merseyside. It was agreed that in 1939 they report on their area for the national bird survey being carried out by the scientific committee of the British Trust for Ornithology, and for the selected list of trees and insects chosen for national observation by the B.E.N.A. headquarters. Arrangements had been made for combination with the branches of the B.E.N.A. for Manchester and West Lancashire (Lytham).

### The Parliamentary Science Committee

THE fifth annual meeting of the Parliamentary Science Committee was held at the House of Commons on December 13, under the presidency of Prof. J. Graham Kerr. The honorary secretary's report disclosed that the Committee's constituent bodies now number twenty-six, five of which have become affiliated during the past twelve months. Three peers and fourteen Members of Parliament are now associated with the executive, with the result that the Parliamentary activities of the Committee have greatly extended. Interventions in debate on the initiative of the Committee were frequent last session; more than thirty questions were asked in the House of Commons on scientific and technical matters; and during the current session it is hoped that members will be fortunate in the ballot for private members' motions. The Committee has been associated with Parliamentary action on the Thames barrage and the removal of the oil tanker limits on the Thames. Negotiations are on foot to establish complete liaison with the new Division for the Social and International Relations of Science of the British Association. Two lectures were arranged during the last session at the House of Commons for Members of Parliament. The following were elected officers for 1939: *President*, the Right Hon. the Earl of Dudley; *Vice-President*, Sir Arnold Wilson, M.P.; *Chairman*, Mr. S. F. Markham, M.P.; *Vice-Chairman*, Prof. B. W. Holman; *Deputy-Chairman*, Mr. Alan E. L. Chorlton, M.P.; and *Hon. Secretary and Treasurer*, Mr. H. W. J. Stone.

### The Cultural Influence of the Cinema

THE League of Nations Advisory Committee on Social Questions has issued a report, based on information collected from the Governments of forty-six countries and from other sources, on "The Recreational Cinema and the Young" (London: Allen and Unwin. Pp. 32. Price 9*d*.). It discusses the frequency of the attendance of young people at cinema theatres, the effects of attendance, juvenile taste in films, protection from unsuitable films, teaching of film

appreciation, special performances and special films for juveniles. Of outstanding interest under the two last-mentioned headings are accounts of certain activities of the Governments of the U.S.S.R. Their "Children's Cinemas" are, it is said, equipped on broadly conceived lines as recreational centres. In addition to the theatre itself, they include a large hall for games and musical programmes, a library and reading room, a room for quiet table games, a refreshment counter, and a sort of cinema museum in which are displayed exhibits illustrating the history and technique of cinema production with sets of photographs of the best films and leading cinema personalities. Children are encouraged to amuse themselves, before the performance begins, in the various rooms, especially the large hall, where the programme usually is such as to prepare them for understanding the film about to be shown.

APART from the technical staff of these Children's Cinemas, a special staff of teachers is employed in these houses. A special section of the Central Department for Industrial Cinematography employs a regular staff for the making of films for children, the subjects including travel and exploration, animal life, children of the U.S.S.R. and other countries, lives of remarkable persons and works of popular children's authors, among whom are mentioned Mark Twain, Jules Verne, Swift, Kipling and Pushkin. For the guidance of makers of such films certain basic principles have been prescribed, such as: "Any attempt to address children otherwise than in the real language of art, to 'talk down' to the child's intellectual level—i.e., any conscious or deliberate simplification—makes the juvenile film stereotyped and false. It should be simple with the simplicity of a real work of art, but not simplified".

## Technical Progress and Unemployment

AN Advisory Committee on Management (International Labour Organization) at its meeting on May 2 and 3 studied the practical methods which industrial undertakings could adopt to alleviate the immediate social consequences of the elimination of surplus works or technical equipment and of the rapid and extensive mechanization of production (Geneva: International Labour Organization). The Committee drew up a list of measures which might be taken by organizations obliged to reduce their staff in consequence of progressive mechanization or other industrial changes. These measures are classified into five groups according to whether they are preliminary and designed to postpone or minimize or avoid dismissals as, for example, by reduction of hours or transfer of workers to other services; those intended to systematize inevitable dismissals, taking account of all psychological and moral issues involved; those intended to help workers who are dismissed; measures of adjustment among the remaining staff; and general measures involving co-operation with staff representatives, other undertakings and official or private organizations.

IN regard to the measures for dealing with actual dismissals, the Committee stresses the importance of selecting workers for dismissal on the basis of objective criteria, the information of staff in advance and the careful spreading of dismissals over a period. The Committee also considered a report prepared by the International Labour Office on the use of office machinery and its influence on conditions of work for staff. Various technical means of mitigating the physiological and psychological consequences of the mechanization of office work were suggested by the Committee, which in regard to the general effects, expressed the opinion that a reduction of hours of work in offices would assist in reducing those drawbacks. The Committee also holds that to counteract the occupational consequences of the use of machines, the social guarantees recognized as due to the industrial worker should be granted equally to office employees, especially by a general extension of social legislation and of the system of collective agreements.

## The Rockefeller Foundation

THE Rockefeller Foundation in 1937 distributed a total of more than 9,500,000 dollars. Fifty-five per cent of the grants were for work in the United States, and among the largest appropriations and authorizations of the year were 420,000 dollars to the China Medical Board for the maintenance of the Peiping Union Medical College; 360,000 dollars to Harvard University for research in industrial hazards; 300,000 dollars to the Yale University School of Medicine for the Department of Psychiatry; 300,000 dollars to the California Institute of Technology for the development of organic chemistry; 275,000 dollars to the National Research Council for research in problems of sex and in biophysics; 250,000 dollars for the general research fund of the Yale University School of Medicine; 240,000 dollars to the Royal Institute of International Affairs for research in international problems; 156,000 dollars for teaching and research in psychiatry at the Harvard Medical School and Massachusetts General Hospital; 150,000 dollars to the National Institute of Economic and Social Research for basic economic research, and 100,000 dollars to the International Institute of Intellectual Co-operation for research in connexion with the International Studies Conference. The annual report of the Foundation includes the president's review with the detailed reports of the secretary, the treasurer and the directors of the International Health Division, the Medical Sciences, the Natural Sciences, the Social Sciences and the Humanities and the vice-president in charge of the programme in China.

IN the natural sciences, the Foundation has given its major support to experimental biology, including research on hormones, nutrition, and enzyme chemistry, while assistance given to organic chemistry has been largely prompted by a desire to develop work on its biological aspects with the view of forwarding the progress of medicine itself in the United States. The president's remarks on the social sciences are of

special interest at the moment. Emphasizing the importance of scientific work in this field, he suggests that in it lie the possibilities of ultimate social intelligence. Social progress more and more requires minds trained to function scientifically on social problems, as well as improved facilities for observing, recording and interpreting social phenomena and public recognition of the importance of accessions of knowledge in this field. The appropriations of the Foundation in this field in 1937 were largely for the promotion of research in social security, international relations, and public administration. It is satisfactory to note that although the normal development of the work in China has been rudely interrupted, no project has been discontinued, although six out of the eight major projects have been forced to leave the areas in which their work was being done. Reference has already been made in these columns to the president's comments on the barriers to the work of the Foundation which have been encountered through restrictions on intellectual freedom in certain countries (see NATURE, May 21, p. 939).

### The Gas Engine Afloat

IN a paper on "Marine Engineering Problems of To-day" read to the International Conference of Naval Architects and Marine Engineers in June of this year, Mr. Sterry B. Freeman suggests that the time is now ripe for a reconsideration of the gas engine for ship propulsion. On October 11, Mr. J. F. Gibbons read a paper at the Institution of Marine Engineers on "Gas Engines for Small Craft". The author considers only small vessels like tugs, colliers, coasters and trawlers, using gas producers of ordinary type and the power contemplated lying between 300 and 1,500 h.p. Mr. A. E. L. Chorlton in 1913 outlined a proposal for a gas steam plant of 5,500 brake horse-power suitable for driving a Channel passenger vessel, and took as an example the well-known passenger steamer *La Marguerite*. The gas engines in this design were to be arranged athwartship and geared to the paddle-shaft. They were assisted in manœuvring by uniflow steam cylinders, the steam being supplied by a waste-heat boiler operating on the gas engine exhausts. In the early stages of development there was no competition by the oil engine, as it had not yet been developed. The ordinary type of marine steam reciprocating engine often operated more economically. In those days, the cost of coal was much less than it is now so there was less urge to reduce its consumption. The question now is very different. Apart from the national advantage of having fuel in the country that does not need to be imported, a great deal of experience has been gained in the design of small producers for use on road vehicles. In an article in *Engineering* of November 4, it is stated that if the use of gas engines and producers afloat, instead of being tentatively explored by individuals, had been persevered in by established engineering firms, with only a fraction of the financial backing that has been given to Diesel engines, there is little doubt that by now the technical problems would have been commercially solved.

### Does the Mocking-Bird Mock?

THE mocking-bird (*Mimus polyglottos*) repeats notes used by other birds, and one case at least has been recorded where it was able to do so by the time of its first winter plumage, that is, before it had had much experience in listening to other birds. A suggestion has been made, therefore, that long racial habit in mimicry may have impressed these notes upon the genetic complex of the species, so that the young individual inherited, rather than learned, the adopted song—an acquired character in fact. On the other hand, there is a possibility that the repetition of notes may be due to "parallel ability and adventitious similarity rather than actual and individual mimicry". Another suggestion is made by Loye Miller (*The Condor*, **40**, 216; 1938). He interprets the song as a sequence of *motifs*, each *motif* being commonly repeated from three to nine times (making a unit) before a new *motif* is adopted. An ordinary song employs from thirty-five to fifty of such units. Now these *motifs* are largely original; rarely do 10 per cent of them resemble the notes of other species of birds, and the resemblances may be fortuitous or mimetic. But the fact that the notes of the California woodpecker or of the shrike are repeated only in places occupied by these birds, suggests some deliberate mimicry. Miller suggests that the mocking-bird is not to be regarded as a plagiarist, but as an artist picking up a suitable stave wherever it may be found to weave into its own roundelay.

### Improvement of Child Nutrition

AN appeal has been circulated by the Children's Minimum Council, 72 Horseferry Road, S.W.1, for the improvement of the nutrition of children, and to ensure that no child, by reason of the poverty of its parents, be deprived of at least the minimum of food and other requirements necessary for full health. The Council desires that free milk may be available for all school children, and also midday meals in all schools under local education authorities. Where the expenditure available for food is insufficient, it urges the provision of cheap milk for expectant and nursing mothers and children under school age, and free meals for older children. It is maintained that if the known deficiencies in the national dietary were made good, a revolutionary improvement in the public health would certainly follow. The Council needs an income of at least £1,000 a year for the continuance and expansion of its work, and subscriptions are invited for this purpose.

### *Journal of the Czech Astronomical Society*

WITH a delay of only one month during the crushing events of last October, the next issue of *Říše Hvězd*, the monthly journal of the Czechoslovakian Astronomical Society, has been published under an editorial entitled Začínáme Znovu—"We start again". In this editorial, Dr. Hubert Slouka calls upon all Czech astronomers to unite in working together for the creation of a well-equipped Government observatory, even if only a modest beginning can be made.

The need for such an observatory is further intensified by the recent ceding to Hungary of the Astrophysical Observatory of Stara Dala. Astronomers and other men and women of science will unite in wishing a happy outcome to this gallant determination to start anew.

### Publications of the Carnegie Institution of Washington

A CATALOGUE of its publications has been issued by the Carnegie Institution of Washington giving a classified list of publications in various branches of science, international law and literature. Most of the books marked in the classified section as out of print are to be found in the libraries throughout the world which have been selected as depositories of the publications of the Institution. A list of these depositories will be sent on application, and a few copies of each publication are reserved for sale at prices which are less than the cost of printing. Price lists or classified lists may be obtained on request and special lists of reprints relating to the work of the Geophysical Laboratory, the Nutrition Laboratory, the Department of Terrestrial Magnetism and the Mount Wilson Observatory can also be obtained. The catalogue also includes an index of authors.

### Bibliography of Seismology

WE have just received vol. 12, No. 18 of this valuable work, and hope that collaborators in many other countries where seismological work is being done will soon come forward. The U.S.S.R., the Balkan States, and South America, to mention only three, and this time even Germany have no representative. It is pleasing to note that Italian papers are represented, and there is a very full list of American publications. It might be suggested that periodical publications of observatories throughout the world be noticed as, in addition to routine readings of seismograms, the more fortunate observatories find time to investigate shocks local to the station. There is a full list of seismological notes from NATURE.

### Mineralogical Society of America: Roebling Medal

DR. WALDEMAR THEODORE SCHALLER, chief mineralogist of the United States Geological Survey, an authority on rare and unusual minerals, has been awarded the Roebling Medal by the Mineralogical Society of America "for meritorious achievement in mineralogy and allied sciences". This Medal, awarded for the first time in 1937, was established in honour of the late Colonel Washington A. Roebling of Trenton, N.J., whose private collection in the field of mineralogy, now forming part of the display at the United States National Museum, contained some 16,000 specimens, many of them very rare, and was one of the most complete in the country. Colonel Roebling's interest in the growth of the Mineralogical Society led him to create an endowment fund to provide a wider scope in mineralogical publication. The medal commemorates his lifelong concern with mineralogy.

## Announcements

THE following elections to the Paris Academy of Sciences have been announced: Prof. W. J. de Haas, professor of physics in the University of Leyden, to be *correspondant* for the Section of Physics in succession to the late Dr. C.-E. Guillaume; I. Holmgren to be *correspondant* for the Section of Medicine and Surgery in succession to the late Prof. I. Pavlov; M. Paul Wintrebert, professor of comparative anatomy and histology in the Sorbonne, to be a member of the Section of Anatomy and Zoology in succession to the late F. Mesnil.

DR. HEINRICH RITTER VON SRBIK, professor of history in the University of Vienna, has been nominated president of the Academy of Sciences of Vienna.

THE German Society for the Study of Colloidal Chemistry has awarded its grand annual Laura Leonard prize to Prof. M. Samec of Ljoubljana for his work on the colloidal chemistry of starch.

DR. DESIDOR MISKOLEZY, professor of psychiatry at Szeged, Dr. Roman Adelheim, professor of pathological anatomy in the University of Latvia, Riga, and Prof. Charles Spearman, emeritus professor of psychology in the University of London, have been elected members of the German Academy of Natural Science at Halle.

DR. H. MORLEY FLETCHER is representing the Royal College of Physicians of London at the opening of the Royal Australasian College of Physicians at Sydney. He presented on its behalf to the new College an illuminated address and a replica of its silver wand or caduceus given by Caius in 1556.

AT a meeting on October 28 of the international committee for instruction and action for the protection of a civilian community in war, which was set up at Luxembourg on July 4, sub-committees were formed to deal with propaganda, diplomacy, military matters, medical treatment, legal questions, civilian defence and protection of women. The next meeting of the international committee will be held at Luxembourg next January.

THE Annual General Meeting of the Association of Women Science Teachers will be held in Bedford College for Women, Regent's Park, London, N.W.1, on January 4–5. On January 4, Prof. Alan Ferguson will deliver a lecture entitled "Some Notes on Eighteenth Century Physics". On January 5, a discussion on "New Methods of Biology Teaching emphasizing Practical Problems with Living Organisms" will be opened by Mrs. Hatfield. Further information can be obtained from M. W. Sutton, 18c Christchurch Road, London, S.W.2.

ERRATUM.—In the article on "National Parks" in NATURE of December 17, p. 1087, second paragraph, line 18, for "16,000 ft." read "1,600 ft."

# Letters to the Editor

*The Editor does not hold himself responsible for opinions expressed by his correspondents. He cannot undertake to return, or to correspond with the writers of, rejected manuscripts intended for this or any other part of* NATURE. *No notice is taken of anonymous communications.*

NOTES ON POINTS IN SOME OF THIS WEEK'S LETTERS APPEAR ON P. 1123.

CORRESPONDENTS ARE INVITED TO ATTACH SIMILAR SUMMARIES TO THEIR COMMUNICATIONS.

## Coherent Modified Scattering of Light

IT has been assumed hitherto that when light is diffused by the particles in a medium with frequencies different from that of the incident light, the radiations from the particles are necessarily incoherent with each other. The following considerations indicate that this need not always be the case, and indeed that coherence is possible and may play a very important part in the scattering of light with altered frequency.

Consider two neighbouring volume elements in a medium and assume that as a result of translatory or rotatory movements of the molecules contained in them, the optical properties of these volume elements vary with time. This variation may be analysed into its Fourier components and we may, for the moment, fix our attention on a component having the frequency $\nu^*$. Under the influence of the incident monochromatic light of frequency $\nu$, each of the volume elements will emit secondary radiations of frequency $\nu \pm \nu^*$. Since the incident light wave at the two volume elements has a definite relation of phase, the scattered radiations would also be partially or completely coherent, provided that the fluctuations of frequency $\nu^*$ in the optical properties of the two volume elements are either partly or completely correlated in phase. If such a correlation of phase exists, it must be considered in evaluating the intensity of the modified scattering which is the resultant of the effect of the different volume elements in the medium. It will be readily seen that in general, the resultant intensity would be different in different directions of observation.

If the frequency $\nu^*$ be small, the detection of the modulated frequencies, $\nu \pm \nu^*$, would require the use of an interferometer. A correlation of phase of the oscillations in the neighbouring volume elements would necessarily exist, if there are *stationary* waves in the medium covering a wide range of frequencies. In those directions where the phases of the scattered radiations are most nearly in agreement, we should expect the scattered light to show most strongly the modulated frequencies $\nu \pm \nu^*$. An explanation is thus forthcoming of the effects depending on the direction of observation, which have been observed in interferometric studies of light-scattering in fluids and solids.

The point of view here suggested has the merit of bringing the observed changes of frequency under the single general principle governing all such changes, namely, that the frequency of the scattered light is the sum or the difference of the frequency of the material particles and of the radiation frequency. It is thus more general than the well-known theory due to Brillouin,[1] which regards the observed displacements of frequency as Doppler effects arising from *progressive* sound waves in the medium. According to the concepts here outlined, the scattered light should in general exhibit a continuous spectrum with maxima of intensity depending upon the direction of observation rather than discrete frequencies as suggested by Brillouin's theory. The appearance of the component of unmodified frequency also receives an instantaneous explanation as due to the existence of local fluctuations of infinitely low frequencies in the medium. The new point of view also indicates that harmonics of the oscillation frequencies should be observable in favourable cases as frequency shifts in the scattered radiation.

A further application of the idea of coherence to the problem of light-scattering seems to arise in the case of those oscillations in crystals which are classified under the heading 'lattice frequencies'. It would seem difficult to explain the great intensity with which frequency shifts of this class appear in the light-scattering by crystals unless a coherence in phase of the oscillations of the neighbouring lattice units in the solid is assumed to exist. This idea, however, requires further examination, and we are putting it forward in this note with due reserve.

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Hebbal, Bangalore. C. S. VENKATESWARAN.
Nov. 20.

[1] Brillouin, L., *Ann. Phys.*, **17**, 88 (1922).

## The Sub-Arctic Region as a Molluscan Habitat

THE Mollusca, as an ancient, widely distributed and relatively diversified group of animals, provide favourable material for biogeographical study. The freshwater and terrestrial Mollusca of the Sub-Arctic Region (which may be defined as the territory lying between the fiftieth parallel of north latitude and the Arctic Circle except in north-western Europe and western North America, where the boundaries lie farther north) are of special significance since in that region the effect of progressively more unfavourable conditions of life upon animal distribution can be observed upon a vast scale. The following note, which is based upon original observations[1,2,3,4], may therefore be of interest.

The presence of a relatively small number of species, many of which have a wide geographical range, and are to be found in large numbers of individuals, is the most characteristic feature of the molluscan fauna of the Sub-Arctic Region. Conditions of life for molluscs in this northern region are evidently so severe that the majority of the species which inhabit the southern part of Europe, Asia and North America are unable to survive in the sub-arctic sectors of those continents.

In some instances the molluscs which are found in the Sub-Arctic belong to 'archaic' groups which in former times occupied a more or less predominant position in the molluscan fauna of the world, but have now been superseded over the greater part of the earth's surface by more recently evolved and

apparently better adapted forms. The super-family of land snails known as Orthurethra, which includes the families Valloniidæ and Pupillidæ may serve as an example. This super-family is a group of primitive Basommatophora (Mollusca, Pulmonata) of which the existing members are the scattered descendants of an ancient snail fauna of the world. The few survivors of this group which are still found on the great continental land masses now occupy the poorer habitats and the less-favourable regions, such as the Sub-Arctic, into which many species belonging to the more recently evolved groups of snails have not followed them as yet.

It may be seen to be somewhat remarkable that although the hardy molluscs which are able to survive under sub-arctic conditions have had the ground to themselves, there has been little tendency for them to give rise to new species and varieties which are characteristic of different parts of the territory. Apart from a conceivable direct physical effect of low temperature upon the rate of evolutionary change, the explanation of the very limited degree of speciation in the Sub-Arctic may well lie in the geographical conditions, and particularly in the sameness of the environment over vast tracts in this region. Only a very few types of landscape are found in the Sub-Arctic[3], and in each of them conditions of climate, soil and vegetation are strikingly similar at widely separated points. This must surely result in there being only a limited number of food chains available to the animal inhabitants of a given area. Under such conditions it seems to be reasonable to conclude that the opportunities for new species to establish themselves successfully are correspondingly limited as compared with other areas having a more diversified landscape.

There are certain exceptions to the general rule of sameness, and poverty so far as the number of species is concerned. The most notable of these exceptions are to be found in the freshwater families Lymnæidæ and Planorbidæ (Mollusca, Pulmonata), and in the fauna of Lake Baikal. The usual habitat of Lymnæidæ and Planorbidæ is in ponds and lakes. As a result of widespread glaciation within relatively recent times, ponds and lakes are common in many parts of the Sub-Arctic and even a casual examination reveals a wide range of different physical, chemical and biological conditions in them. So far as these particular molluscs are concerned, therefore, the opportunities for diverse modes of life (which probably form the basis of any successful attempt by new species to establish themselves) are quite considerable. The other outstanding exception is the molluscan fauna of Lake Baikal. This is a large body of fresh water situated in Eastern Siberia approximately midway between Calcutta and the mouth of the River Lena. The animal population of this lake is of a highly remarkable character. Approximately ninety per cent of the species of animals, the majority of the genera, and many of the larger groups are strictly confined to this one body of water. Moreover, the fauna is a rich one. The exact number of species of Mollusca which are present is not known[5,2], but it is believed to be large. The explanation of the presence of this highly peculiar and abundant fauna in Lake Baikal probably lies in the uninterrupted biological history of this body of water since Jurassic (?) times, and the great diversity of conditions met with in the Lake. In this latter connexion, the profound depth of the Lake (maximum 1,741 m.) is probably of some significance.

The impression gained from a study of the Sub-Arctic Mollusca, therefore, is that the general character of the fauna has been brought about to a considerable extent by geographical conditions and particularly by the types of habitat available. If there was once more a clear field in the region and comparable biological material found its way into the country, there appears to be a considerable likelihood that although the channels of development might be different, the resulting fauna would be of very much the same character as the one which exists in the region to-day.

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Nov. 18.

[1] Mozley, Alan, "Reports of the Jasper Park Lakes Investigations, 1925–26. The Molluscs of Jasper Park", *Trans. Roy. Soc. Edin.*, **56**, 647–669 (1930).
[2] Mozley, Alan, "The Fresh-Water and Terrestrial Molluscs of Northern Asia", *Trans. Roy. Soc. Edin.*, **58**, 605–695 (1935).
[3] Mozley, Alan, "A Biological Study of the Sub-Arctic Molluscs", *Proc. Amer. Phil. Soc.*, **78**, 147–189 (1937).
[4] Mozley, Alan, "The Fresh-Water Molluscs of Sub-Arctic Canada", *Can. J. Res.*, **16**, 93–138 (1938).
[5] Kozov, M. M. (= Kojov, M. M.), "Mollusques du Lac Baikal. Trav. Stat. Limnologique du Lac Baikal", (8), *Acad. Sci. U.S.S.R.* (1936).

## Directed Hereditable Variations Conditioned by Euploid Chromosome Alterations in Higher Plants

IN studying a series of eupolyploid plants produced during the last few years[1] and especially those produced recently by colchicine and acenaphthene treatments[2,3,4,5] in Solanaceæ, Compositæ, Gramineæ, etc., I found that eupolyploid chromosome alterations condition a series of hereditary variations. Most of them are directed; others are not. Directed hereditable variations in plants which show an increase with the euploid increase of the chromosomes are: (1) amount of nucleolar substances (number of nucleoli, size, or both); (2) volume of the nuclei; (3) amount of cytoplasm per cell; (4) volume of the cell; (5) breadth of the leaves; (6) thickness of the leaves and the weight of unit surface portions of the leaves; (7) size and weight of the ovules; (8) size and weight of the seeds or of the grains; (9) size and weight of the anthers; (10) breadth of the styles and stigmas; (11) breadth of the petals; (12) thickness of the petals; (13) length and breadth of all kinds of trichomes (on the leaves, stems, flowers and seeds); (14) number of the chloroplasts per cell; (15) amount of chlorophyll at unit leaf surface; (16) expression of the green colour of the leaves; (17) expression of the corolla colours, and (18) metabolic (photosynthesis) and katabolic (carbon dioxide) processes per unit leaf surface.

The length of the vegetation period (from planting of the seeds until the beginning of the flowering) increases in almost all plants with doubled chromosome numbers. Most of the latter plants are larger than their 'diploid' forms. This is especially true for plants with relatively small chromosome numbers. But there are also cases when chromosome duplication does not necessarily lead to an increase of the plant size. In a few cases polyploids are smaller than their original diploids (octoploid *Nicotiana Sanderæ*). The length of the flowers (corolla and calyx) and the breadth of the corolla behave in a similar way. All organs of the polyploid plants appear coarser.

The sizes of the fruits and capsules change in different ways. They are chiefly regulated by the number of the seeds. The number of the seeds, that is, the suppression of fertility in autopolyploids, depends greatly on the length of chromosomes and on the degree of polyploidy (chromosome number). Plants with longer chromosomes set much smaller percentages of seeds per capsule in respect to their original forms than plants with shorter chromosomes. When the plants have chromosomes approximately equal in length, those of them that have many more chromosomes (higher polyploidy) set less seeds per capsule. This is true for higher degree of polyploidy. It does not always hold for the members of the polyploid series with smaller chromosome numbers. These regularities are of great evolutionary significance.

The contents of various chemical substances are altered in different directions as results of chromosome duplications.

Polyploids have not larger plastids. The latter show great autonomy in respect to the nucleus (chromosomes, genes).

Hereditary variations conditioned by euploid chromosome alterations are of great agricultural value, because we can predict, for most of them, the direction of changes after chromosome doubling. Contrary to this, all hereditary variations conditioned by gene mutations, and structural or aneuploid chromosome alterations, that we can induce at the present time, are not directed.

The realizations of the characters in polyploid plants compared with those of their 'diploids', as described above, are contrary to the mechanistic conception of the nature and behaviour of the organisms.

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[1] Kostoff, D., *J. Genetics* (In the Press).
[2] Kostoff, D., *C.R. Acad. Sci. Moscow*, **19**, 197–199 (1938).
[3] Kostoff, D., NATURE, **141**, 1144–1145; **142**, 753 (1938).
[4] Kostoff, D., *Current Science*, **6**, 549–552; **7**, 8–11, and in the Press (1938).
[5] Kostoff, D., *Priroda* (In the Press).

## Genetics of Hybrid Sterility

IT is a remarkable fact that the disturbances connected with genic sterility in hybrids between species (or races) are paralleled within species by similar disturbances caused by single genes. For example, there is an analogy between the asynaptic mutations in several plants and genic asynapsis in hybrids and likewise between the polymitotic mutation in *Zea* and the spermatogenesis in *Drosophila pseudo-obscura* hybrids. Similarly, I have recently found a property analogous to the long-chromosome mutation in *Matthiola* in a grasshopper hybrid, the chromosomes of which also show a sort of 'stickiness' reminding one of the 'sticky' mutation in *Zea*[1]. Dobzhansky has several times directed attention to this parallelism[2], though he does not seem to think it has any deeper genetical significance. In my opinion, there is, however, a possibility of putting the two phenomena on a common basis.

Dobzhansky's admirable work on hybrids between *Drosophila pseudo-obscura A* and *B* has shown that at least eight sterility genes, spread out over the whole set of chromosomes, are present, all of them having like and cumulative effects. We may presumably take for granted that such series of sterility genes are at work in other cases of genic sterility in hybrids as well. Assume that these genes are of the same kind as the sterility genes known to act within species. But instead of having one recessive with a strong effect, we are concerned with a series of recessives with but slight effects. Assume further that they only become effective if a certain, not too small, minimum number is present in a homozygous state. Then, even a moderate mutation pressure will be able to infiltrate a cross-breeding population with mutated genes until the proportion of them at every locus concerned approaches or exceeds 50 per cent. The distribution of mutated loci in any gamete produced in the population, with random mating and absence of linkage, is given by the binomial expansion. Thus the number of mutated loci present in a gamete in a population of moderate size will vary within relatively narrow limits, being usually about half the number of sterility genes in the whole population. Since the mutated genes of two gametes constituting an individual will as a rule be at different loci, individuals homozygous for as many genes as to cause sterility will practically never arise (except on inbreeding). The accumulating evidence as to the occurrence of deleterious recessives in wild populations indeed makes it conceivable that such genes with very slight, but cumulative, effects are widely spread.

The species (or races) engaged in a cross will probably have developed their sterility genes during and after their isolation from each other. Different environments and pure chance will have led, for the most part, to different sets of sterility genes becoming established. At the same time a genetic system making the genes concerned recessive must have arisen (Fisher[3]); these systems, too, must be different, each acting on its own set of genes only.

Consequently, on crossing related species two sets of sterility genes would enter the hybrids. The specific recessive-making systems would break down (*cf.* Harland's work on *Gossypium* hybrids, reviewed by Dobzhansky[2]). The two series of sterility genes, now dominant or semi-dominant, would combine to give the same sterility effect as they would in a homozygous state in a non-hybrid individual.

HOLGER KLINGSTEDT.

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Nov. 12.

[1] Klingstedt, NATURE, **141**, 606 (1938).
[2] Dobzhansky, "Genetics and the Origin of Species" (1937).
[3] Fisher, "The Genetical Theory of Natural Selection" (1930).

## Occurrence of Burbot in the Estuary of the River Severn

A SYSTEMATIC study has been made during the past year of the fish and invertebrates caught in the kypes or 'fixed engines' secured between tide marks in the upper regions of the Bristol Channel, between Avonmouth and Gloucester. During the spring of 1938, three specimens of the burbot, *Lota vulgaris*, were obtained. Two, measuring 9 cm. and 10·5 cm. long respectively, were caught during February in kypes at Oldbury, and the third, 11·5 cm., during March at Hallen, some eight miles nearer to the sea. These appear to be the first modern records of this fish in the West of England, although it is not uncommon in the rivers which flow into the

North Sea between Durham and East Anglia and is of general distribution in northern and eastern Europe.

It is possible, however, that this fish has been previously observed in the estuary of the Severn. Mr. L. H. Matthews has directed my attention to a list of fishes contained in John Smyth's "Berkeley Manuscripts" written at the end of the sixteenth century. This is a description of the Hundred of Berkeley in the County of Gloucester with an account of its inhabitants, and among the fish listed is the "Eele pout", one of the various English names of this interesting freshwater representative of the Gadidæ.

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## Effect of Organic Acids on Germination, Growth and Ascorbic Acid Content of Wheat Seedlings

SEVERAL observations made on dehydrogenase activity of various seeds have been described by Thunberg[1,2]. These investigations have directed attention to the fact that different seeds show different capacities for the utilization of dehydrogenase substrates.

In the experiments here sketched, an attempt has been made to follow the effect of various aliphatic organic acid substrates of dehydrogenase systems on the germination and growth of wheat seedlings, and also their effect on the ascorbic acid content of the germinated seeds.

The sterilized seeds, pure line Wilhelmina wheat from the National Institute of Agricultural Botany, Cambridge, were germinated on moist filter paper placed in sterilized Petri dishes. Each dish contained thirty seeds. The acids were dissolved in sterile twice distilled water and were stored on ice. The technique of these experiments was similar to that already published by Havas[3]. Acids were used in two concentrations, namely, 5/1,000 and 1/10,000, this choice being based upon experience obtained in earlier experiments of a similar nature[4]. The duration of the experiments was twelve days, by which time the food reserves of the seeds were exhausted. The results obtained involved examination of some 1,600 seedlings.

The observations have shown that different acids of the same concentration exert entirely different effects on the growth and germination of the wheat seedlings. At a concentration of 5/1,000, an inhibiting action was observed in each case. Despite the fact that such hydrogen ion concentrations (*p*H 3·0–4·0) are not optimum for the germination of wheat seedlings, this inhibiting action cannot be due entirely to the acid reaction of the solutions, since if this were the case one would expect that each acid would act similarly. This, however, is not the case. Such acids as citric, lactic and succinic, which are the substrates of the most important dehydrogenase systems, do not inhibit germination or growth completely even at a concentration of 5/1,000. The inhibition is only of the order of 60–70 per cent at a concentration of 5/1,000, whilst fumaric, malonic, oxalic and pyruvic acids exert a completely inhibitory effect on germination at this concentration. This action is all the more interesting because, according to Fodor's investigations[5], wheat-germ extract produced the longest decoloration time with citric, lactic and succinic acids as substrates. Furthermore, glycerophosphoric acid solution at the same concentration (*p*H 6·8) caused only a 35 per cent inhibition of growth. At 1/10,000 concentration, no difference was detected between the experimental seedlings and the controls.

Estimation of the ascorbic acid content of the seedlings at the end of the twelfth day showed that whilst seedlings treated with 1/10,000 solution did not give greater values than the controls, those treated with 5/1,000 solutions gave 40–50 per cent increase in ascorbic acid content. Johnson and Zilva[6] described several plants and fruits containing ascorbic oxidase with an optimum *p*H 5·0–7·0. It might be supposed that germinating and growing wheat seedlings contain an ascorbic oxidase which is inhibited in consequence of acid treatment. This, however, cannot be so, since experiments have shown not only that ascorbic acid added to the wheat-germ extract of *p*H 6·8–7·7 is not oxidized more rapidly than the control, but even a protection against oxidation is observable. An ascorbic acid synthesis from the three substrates seems also unlikely, on account of an insignificant increase of ascorbic acid found in the case of 1/10,000 concentration. It seems likely that a disturbance of some regulatory mechanism of the ascorbic acid formation is responsible for the increased ascorbic acid content in the above-mentioned cases. Monoiodoacetic acid has been tried to see whether this supposed regulatory mechanism is connected with the carbohydrate metabolism of the wheat-germ. Monoiodoacetic acid is highly toxic for the growth of the seedlings; even in a concentration of 1/10,000 it produces 55 per cent inhibition. However, it has no influence on the ascorbic acid content of the shoots.

Summing up the various observations made in the course of the present work, it was found that certain aliphatic acids are capable of influencing the growth, germination and ascorbic acid production of the wheat seedling. The divergent action of various acids and their connexion with the ascorbic acid increase of the germinating wheat seedlings obviously points to a complicated relationship between them and an ascorbic acid controlling system.

Details of the experimental results will be published elsewhere.

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[1] Thunberg, *Skand. Arch. Physiol.*, **54**, 6 (1928).
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## Glycolysis in Barley

THE sugars commonly present in barley tissues are the usual plant trio, sucrose, glucose and fructose. Their relation with the plant's respiration has been the subject of much investigation; the following scheme is based on evidence collected in my laboratory over several years.

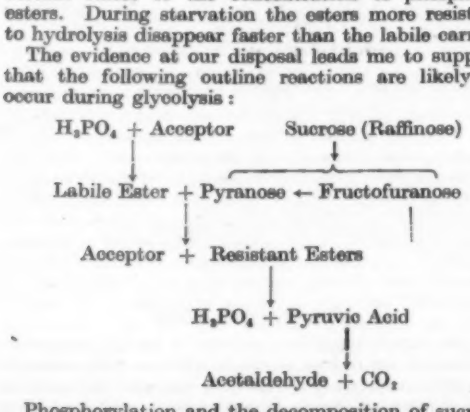
Sucrose is always unstable in the tissues, and a high concentration can only be maintained by rapid synthesis; when this ceases, disappearance is rapid both in young seedlings[1] and mature leaves[2]. The

breakdown of the sucrose is by hydrolysis yielding α-β-glucopyranose and fructofuranose. The fructofuranose reverts rapidly to α-β-fructopyranose; but in the presence of cell catalysts is decomposed more rapidly than the pyranose. Acetone preparations of young tissues will decompose fructofuranose arising in the hydrolysis of sucrose or inulin, but will not attack either glucopyranose or fructopyranose. The system is probably a zymase, since it is active both in the absence and presence of oxygen and is not extracted by water. There is an inverse relation between the rate of hydrolysis and the amount of sugar broken down, some component of the zymase being readily saturated.

It seems sometimes to be supposed that the breakdown of fructofuranose would be incompatible with the occurrence of a phosphorylation cycle; but this is not necessary in theory nor probable in fact. The breakdown of pyranose which is suppressed by the acetone treatment certainly occurs in the living tissues. The disappearance of sucrose from starving leaves is associated with a temporary accumulation of glucopyranose, which is not enough to account for half the sucrose loss. Fructose does not accumulate, and the glucopyranose is soon broken down. In germinating seedlings sucrose, together with raffinose, also a fructofuranoside, is extensively consumed and, during starvation, hexose accumulation is again equivalent to less than half the loss of sucrose.

Mr. S. E. Arney and I have obtained evidence that these breakdowns are associated with phosphorylation. The conflicting results of earlier work were probably due to the facts that young tissues always contain a large amount of free inorganic phosphate, and that esterification is limited by the capacity of some acceptor. Seedling tissues have been found to contain small quantities of a phosphate carrier which loses phosphate by hydrolysis at a rate similar to that of adenylpyrophosphate. More stable esters are also invariably present, and probably include hexosephosphates. Under extreme starvation, the rate of carbon dioxide production becomes proportional to phosphate supply. With excess of free phosphate the respiration rate is still proportional in certain states to the concentration of phosphoric esters. During starvation the esters more resistant to hydrolysis disappear faster than the labile carrier.

The evidence at our disposal leads me to suppose that the following outline reactions are likely to occur during glycolysis:




Phosphorylation and the decomposition of sucrose go on simultaneously. The preferential decomposition of the fructofuranose may be due to its easier phosphorylation or to some entirely non-phosphorylatory mechanism which is of little effect with pyranoses. We cannot at present decide between these alternatives. Whichever happens seems to be accompanied by the phosphorylation of pyranose, some of which may be derived from reversion of the furanose itself.

Pyruvic acid does not accumulate in any barley tissues we have examined, but is very readily broken down by acetone and other dead preparations, as well as by the tissues themselves when alive. Acetaldehyde is formed and carbon dioxide given off[3]. These reactions will occur in the presence of atmospheric oxygen, but we must reserve judgement as to their occurrence or suppression in the presence of respiratory oxidations.

Details of these investigations will be published in a series of papers in the *New Phytologist*.

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Nov. 25.

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## Coagulation by Shearing and by Freezing

IN an attempt to find out how the most available silkworm (larva of *Bombyx mori*) makes the insoluble fibroin strands of its silk from the stiff water-soluble fibroinogen paste which forms the cores of the contents of its silk depots, two of the observations made have so much general interest that I send a brief account of them in the hope that others will either contribute to their explanation or direct attention to corresponding phenomena in other cases.

(1) When the isolated fibroinogen paste is sheared by squashing it firmly between two flat plates of glass (or mica or 'Perspex'), an irregularly striated, semi-opaque, doubly refractive membrane is formed which is insoluble even in *N*/10 sodium hydrate solution, and is far too thick to consist of hypothetical membranes coagulated by adsorption and rubbed off the surfaces of the plates.

(2) After a not too dilute aqueous solution of the paste has been frozen solid by immersion in ice-salt mixture at −13° to −17° C. for a quarter of an hour and then allowed to thaw, most of the fibroinogen is found to have undergone irreversible coagulation. Certain salts (for example, 0·9 per cent sodium chloride) prevent this change.

This coagulation by freezing might conceivably be either a special case of coagulation by shearing or a coagulation by electrolytes, since the protein and any other solutes would become steadily more concentrated as ice crystals increased, and growing ice crystals would shear the protein paste eventually produced. If it is a coagulation by shearing, both observations would find a common explanation, and the one I would tentatively suggest is that, during the shearing, contiguous fibroinogen molecules would be strained and distorted, and possibly activated, and that while being thrust past their neighbours or rolled over them, potentially mutually reactive hydrophil groups would be given opportunities to unite with each other, groups which in the unsheared paste would not be strained and would be kept apart by hydratation shells. The fact that fibroinogen in aqueous solution is thermostable is in no way inconsistent with this suggestion.

As bearing on coagulation by freezing, I should add that fibroinogen in aqueous solution, although

thermostable, is nevertheless eminently surface-coagulable, that is, like egg-albumin, fibrinogen and certain other proteins[1], when adsorbed from aqueous or aqueous saline solution at interfaces with any gas or with various neutral oils, it promptly forms a coagulated surface membrane which can be dragged off as a thread, if traction is exerted on it while it is being formed and is still sufficiently plastic.

This surface coagulability makes it necessary to state that the coagulation by freezing is far too massive to be explicable as coagulation solely at the surface of frozen-out gas bubbles. Further, when solutions of egg-albumin are frozen, coagulation is limited to the surfaces of the frozen-out gas bubbles.

I had expected to find that coagulation by surface influence was responsible for the conversion into fibroin, but observation (1) and others, an account of which will, it is hoped, appear shortly, have led to the conclusion that absorptional coagulation proper has nothing to do with it, and that the conversion is brought about, either entirely or almost entirely, by the shearing to which the paste is subjected in the silk-channels.

*Added in proof, Dec.* 3. I now find that Foà[2], investigating spontaneously coagulable aqueous extracts of finely divided silk-depots, solutions which would contain much besides fibroinogen, observed that freezing 'accelerated' their coagulation, and also that fairly thick layers of coagulated protein (doubtless 'surface-coagulated', W.R.) collected on solids dragged repeatedly from their free surfaces. From this latter fact he inferred that the coagulation of depot content into the fibroin of silk was brought about by traction.

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Nov. 24.

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## Œstrogenic Activity of Anol; a Highly Active Phenol Isolated from the By-Products

IN a previous communication[1], it was suggested that the œstrogenic activity of crude specimens of anol and of the mother liquor from these preparations may be due to the presence of a polymer possessing an extremely high degree of potency. The active substance has been isolated by the following procedure:

Anethole was demethylated by heating in an autoclave with potassium hydroxide and alcohol. The phenolic products were completely re-methylated and from the mixture of methyl ethers, anethole, together with some *p*-methoxy-*n*-propyl benzene, was removed by steam distillation. The residual thick oil was distilled at 0·15–0·2 mm., when almost half passed over between 160° and 170° C. and produced œstrus in rats with doses of 2 mgm. This oil fraction was oxidized by treatment with finely powdered potassium permanganate in ice-cold acetone and the products separated into anisic acid (i), α-(*p*-methoxy-phenyl)-*n*-propyl methyl ketone (ii) and a saturated oil (iii). The production of (i) and (ii) demonstrates the presence among the products of demethylation, of the di-anol already described by us[2].

The saturated oil gradually deposited a small amount of a crystalline substance which, after purification, melted at 144° C. and gave on analysis: C, 80·7; H, 8·8; $CH_3O$-, 20·1 per cent. ($C_{20}H_{26}O_2$ requires C, 80·5; H, 8·8; $CH_3O$-, 20·8 per cent.) When this substance was demethylated, the resulting phenol melted at 184–185° C., and gave on analysis C, 79·9; H, 8·2 per cent ($C_{18}H_{22}O_2$ requires C, 80·0; H, 8·2 per cent.)

The phenol produced full œstrus response in all rats when administered in doses of 0·2 γ. Doses of 0·15 γ gave 60 per cent and doses of 0·1 γ gave 20 per cent response.

The substance proved to be identical with the 4 : 4′-dihydroxy-γ : δ-diphenyl-*n*-hexane, produced by hydrogenation in presence of palladium of 4 : 4′-dihydroxy-γ : δ-diphenyl-β : δ-hexadiene[3], or of 4 : 4′-dihydroxy-α : β-diethyl stilbene[4], although in poor yield from the latter.

A full account of the synthetic work on these substances is now being prepared, and will shortly be submitted for publication in collaboration with Mr. L. Golberg and Prof. R. Robinson.

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[1] Dodds, E. C., and Lawson, W., NATURE, **139**, 1068 (1937).
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[3] Dodds, E. C., Golberg, L., Lawson, W., and Robinson, R., NATURE, **142**, 34 (1938).
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## Trimethylamine in Menstruous Women

HAVAS'S recent communication in these columns[1] on the suggestive hormonal properties of trimethylamine recalls the fact that it was so long ago as 1902 that Michin[2] first directed attention to the presence of trimethylamine in the vaginal secretion of women. Michin carried out his investigations on Russian women. Briefly, his findings were as follows:

The percentage of trimethylamine in normal women varied between 0·07 and 0·72, with a mean of 0·33. In women with various genito-urinary disorders the range was 0·00–0·64 per cent.

Cases with metastatic tumours were associated with a significant increase in the amount of trimethylamine; more benign tumours with a less appreciable increase. In primiparæ, the average amount was 0·30 and in secundiparæ 0·29. During parturition, the amount is between 0·1 and 0·86 per cent, with a mean of 0·31. In four out of nine women at the climacterium no trimethylamine was found, and in five others it was more or less reduced. In post-menopausal women, trimethylamine was altogether absent. Trimethylamine was found to be very bactericidal, and in a solution of 1 : 15,000 completely inhibited the growth of most bacteria and reduced the activity of others.

It is of interest here to note that in 1927, Klaus[3] obtained trimethylamine from the menstrual discharge, and in 1930 Lanczos[4] found that a preparation of frog's gastrocnemius muscle loses excitability when either the nerve or the muscle is treated with dilute solutions of trimethylamine. She also found that the same effect is obtained when these structures are held by a menstruous woman for 10–15 minutes. This suggests that trimethylamine may be excreted through the skin during menstruation, and that the

deleterious effects which the contact of menstruous women are said to exert upon such things as hams, preserves, bread, wine, and flowers, may be attributable to the action of this substance. Experiments which I have had under way for some time lend strong support to this suggestion

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[3] Klaus, K., "Beitrag zur Biochemie der Menstruation", *Biochem. Z.*, **185**, 3–10 (1927).
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## Temperature Influence on the Pressure Broadening of Spectral Lines

THE classical theories of pressure broadening of spectral lines given by Lorentz[1] and by Weisskopf[2] lead to the following intensity distribution in an absorption line:

$$K_\omega = \text{Const.} \frac{\gamma}{(\omega-\omega_0)^2}, \qquad (1)$$

subject to the condition $\omega \gg \gamma/2$. Here $\gamma/2$ is the number of collisions per second of the absorbing atoms with the perturbing ones, $K_\omega$ the absorption coefficient for frequency $\omega$, and $\omega_0$ the frequency corresponding to the centre of the line. If the concentrations of absorbing and perturbing atoms are constant, Lorentz's theory predicts $\gamma \sim \sqrt{T}$, where $T$ is the absolute temperature of the gas. Taking into account Weisskopf's relation between impact diameter and relative speed of colliding atoms, we find $\gamma \sim T^{3/10}$. Under special conditions, relation (1) follows as a limiting distribution from the wave-mechanical theory given by one of us[3,4]. In this theory, the width of spectral lines does not depend directly upon the number of collisions per second, although it does depend upon the kinetic energy of colliding atoms and upon the shape of potential curves.

So far as we know, Orthmann[5] was the only one who investigated the dependence of line broadening upon temperature at constant concentration of absorbing mercury atoms as well as of perturbing hydrogen molecules. His results agreed with the theory of Lorentz. We have investigated the broadening of the Hg absorption line 2537 A. caused by helium at the concentration of $8{\cdot}8 \times 10^{14}$ mercury atoms and $1{\cdot}24 \times 10^{19}$ helium atoms per c.c. The gases were contained in a silica tube 150 cm. long. The absorption spectra were photographed by means of a Hilger quartz spectrograph (dispersion 1·6 A./mm.). As is well known, the lines broadened by the presence of light gases show a symmetrical intensity distribution similar to that given by the relation (1). It is usually thought now, that in this case the broadening is due mostly to the so-called collision damping effect, which depends upon the temperature; the role of statistical effect, which does not depend upon temperature, should be negligible. The use of a mercury-helium mixture enabled us to vary the gas temperature within very wide limits without changing the atom concentration.

It is well known that the total quantity $A$ of light absorbed from a continuous background (as well as the surface limited by the curve in the accompanying graph) by a line with intensity distribution given by (1) is, *caeteris paribus*, proportional to the square root of the line width:

$$A \sim \gamma^{1/2} \qquad (2)$$

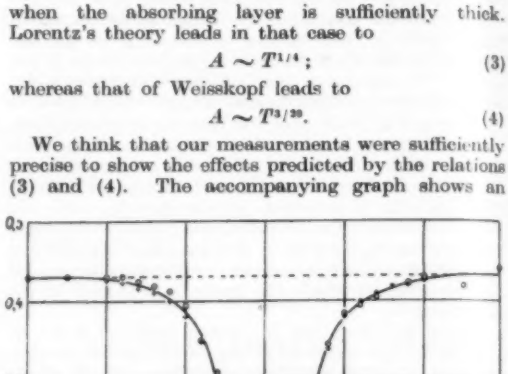
when the absorbing layer is sufficiently thick. Lorentz's theory leads in that case to

$$A \sim T^{1/4}; \qquad (3)$$

whereas that of Weisskopf leads to

$$A \sim T^{3/20}. \qquad (4)$$

We think that our measurements were sufficiently precise to show the effects predicted by the relations (3) and (4). The accompanying graph shows an




HG ABSORPTION LINE 2537 A. BROADENED BY HELIUM. BLACKENING OF PHOTOGRAPHIC PLATE AS FUNCTION OF DISTANCE FROM CENTRE OF LINE. + ABSORPTION SPECTRUM AT 398° K.; ○ ABSORPTION SPECTRUM AT 1195° K. 1 CM. CORRESPONDS TO 0·23 A.

absorption curve obtained from absorption photographs taken at 398° K. (crosses) and at 1198° K. (circles); the blackenings of continuous background given by the hydrogen discharge tube were reduced to constant intensity. The curves for both these temperatures are seen to be identical within the limits of experimental error (for the lower temperature the surface limited by the curve is about 4 per cent greater than the surface limited by the curve corresponding to the higher temperature; but this difference lies within the limits of experimental error). This result indicates that the broadening of the Hg absorption line 2537 A. caused by helium does not depend appreciably upon the temperature.

Similar researches upon the influence of other gases upon the mercury line 2537 A. will be undertaken shortly.

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Nov. 3.

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### Humidity in the British Isles

IN an article in NATURE of August 20, p. 365, "Humidity in the British Isles", it was stated, referring to Stacey's figures: "It is difficult, however, to draw any useful conclusions from charts and averages based on observations at 9 h., an epoch at which relative humidity is normally in process of descending from the early morning maximum to the afternoon minimum".

I would like to suggest that, on the contrary, readings taken at 9 h. can provide very useful conclusions, because the humidity at that hour approximates very closely to the average over the 24 hours.

In connexion with the moisture content attained by wooden articles in use, this Laboratory wished to arrive at the simplest way of measuring the average hygrometric conditions prevailing, and to that end I had observations of temperature and humidity taken every three hours over a period of years in several types of environment.

In so far as outdoor shade conditions are concerned, it was found that the readings taken at 9 a.m. were nearer to the average over the twenty-four hours than any other single reading. For example, the average difference between them was less than 2 per cent humidity, and the maximum difference 6 per cent, throughout the period April 1934–December 1935. For many purposes this is sufficiently accurate. When an unheated shed such as a timber store was under consideration, it was found that the readings taken at midnight were within 1 per cent humidity of the average. In a heated room such as a museum or other public building, where the number of persons normally present is small relative to the size of the room, the readings taken at 11 h. or noon were within 1 per cent humidity of the average during the heating season October–March.

The above figures indicate, I think, that for purposes where close accuracy is not essential, it is not necessary to go to the expense of obtaining recording apparatus or the trouble of making frequent readings, and data such as those compiled by Stacey can be usefully applied.

It is not denied that observations made at 7 h., 13 h. and 18 h. do cover a wider sphere of usefulness, but the 9 h. observations appear to approximate more closely to the daily average humidity than even the average of the three observations mentioned above. At Kew in 1935, the average daily humidity (0–24 h.) was 77 per cent, and at 7 h., 13 h. and 18 h. it was 84, 66 and 70 per cent respectively (average 73 per cent).

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## Points from Foregoing Letters

AN explanation of the effects observed in interferometric studies of light scattering in fluids and solids is given by Sir C. V. Raman and Dr. C. S. Venkateswaran. They put forward the principle that the frequency of the scattered light is the sum or the difference of the frequency of the material particles and of the radiation frequency. The scattered light should in general exhibit a continuous spectrum with maxima of intensity depending upon the direction of observation, rather than discrete frequencies as suggested by Brillouin's theory.

A. Mozley points out that the molluscs in the Sub-Arctic Region belong to archaic groups which in former times were predominant over the whole world; also that, with the exception of those of Lake Baikal, they show a lower tendency for new species formation. He ascribes this, apart from the possible effect of lower temperature, to the sameness of the environment over vast tracks in the Sub-Arctic Region.

Prof. D. Kostoff gives a list of the characters which change when the number of chromosomes in the nucleus of certain plants has become multiplied through polyploidy. These include the volume of the cells, thickness and breadth of leaves, size and weight of ovules, seeds and anthers. He points out that while the nature of the changes brought about by mutation are unpredictable, the direction of hereditary variations conditioned by euploid chromosome alterations can be predicted and are therefore of great agricultural value.

A hypothesis is offered by H. Klingstedt with the view of putting on a common genetical basis the sterility in species-hybrids and the sterility caused by recessive genes within species.

Fumaric, malonic, oxalic and pyruvic acids in concentration of 5/1,000 are found by Dr. E. Gal to inhibit completely the germination of wheat seedlings; with citric, succinic and lactic acids 60–70 per cent inhibition occurs, whilst glycerophosphoric acid of the same concentration gives only 35 per cent inhibition. An increase of 40–50 per cent in the amount of ascorbic acid present is observed, but the exact nature of the inhibitory mechanism is not yet clear.

Dr. W. O. James submits an outline of the stages by which sugar is oxidized to acetaldehyde and carbon dioxide in barley during the plant's respiration. The following changes: sucrose → fructofuranose (+ α-β-glucopyranose) ⇌ pyranose → resistant esters → pyruvic acid → acetaldehyde, take place, and a phosphorylation cycle goes on simultaneously with the decomposition of sucrose.

Dr. W. Ramsden finds that shearing and freezing of fibroinogen paste of the silkworm produces coagulation, and directs attention to similar observations made by Foà in 1912.

H. Horodniczy and Dr. A. Jabłoński find that the width of the mercury absorption line 2537 A. broadened by admixture of helium (at constant concentration of mercury and helium) does not depend appreciably upon the temperature of the absorbing gas, as would be expected from the theories of collision damping given by Lorentz and by Weisskopf.

R. G. Bateson suggests that humidity readings taken once daily only may compare very closely with the average over the 24 hours provided that the appropriate hour is selected.

# Research Items

### Intoxication and Resistance to Infection

KENNETH L. PICKRELL (*Bull. Johns Hopkins Hosp.*, **63**, 238; 1938) records his experiments on rabbits in which he studied the effect of alcoholic intoxication and ether or avertin anæsthesia on resistance to pneumococcal infection. He found that alcoholic intoxication maintained at the point of stupor destroyed resistance to pneumococcal infection in these animals, their immunity being lost even when they had been rendered highly immune by intravenous injection of anti-pneumococcus serum. Their loss of resistance to infection appeared to be due to the fact that intoxication profoundly inhibited the vascular inflammatory response while intoxication was maintained, and in the absence of capillary dilatation and of margination of the leucocytes, leucocytic emigration at the site of infection was negligible and the bacteria therefore proliferated uninterruptedly. Similar effects were obtained with ether or avertin anæsthesia.

### Rotter's Test for Vitamin C Deficiency

A. G. Zoccoli and V. Lombardo (*Riforma med.*, **54**, 1489; 1938) refer to the intradermal test described by H. Rotter of Budapest (NATURE, **139**, 717; 1937) for determining the degree of saturation of the organism with vitamin C, and record their own investigations on guinea pigs and human subjects. The test depends upon the fact that 2 : 6 dichlorphenolindophenol is discoloured by the tissues at a rate depending upon the ascorbic acid content. When small quantities of the dye are injected into the sole of a guinea pig, decoloration takes place much more rapidly in healthy than in scorbutic animals. The value of the reaction as a rapid clinical test for vitamin C deficiency was confirmed by Portnoy and Wilkinson (*Brit. Med. J.*, **2**, 328; 1938), but not by the present writers, though they admit that with certain modifications the test may be of some use.

### Increase of Gannet Colonies in Shetland

IN a short article upon the gannets of Shetland, James Fisher, Malcolm Stewart and L. S. V. Venables give some figures which illustrate in a remarkable way the rapid increase which may take place following upon the colonization of new and suitable haunts (*British Birds*, **32**, 162; 1938). In 1914, Noss island had a single pair of gannets; in 1918, three young were reared, two years later there were 10 pairs, and since that time numbers have increased by leaps and bounds until in 1938 a careful count revealed the presence of 1518 breeding pairs, with presumably an unknown but very considerable number of non-breeding birds attached to the colony. The second Shetland colony, at Hermaness, probably started in 1917, and in 1938 its breeding pairs numbered 2045. There is nothing here to suggest that the gannet is on the wane in British seas, a fear expressed in a letter recently circulated in the daily newspapers.

### Californian Hepatics

DR. D. H. CAMPBELL has recently given a short account of the prolific hepatic flora of California (*Ann. Bryologici*, **11**; 1938). This rich flora is interesting in view of the climatic conditions of alternation of an almost rainless summer with a wet season. Of the numerous genera of thallose forms, *Sphærocarpus* is the only annual. The larger types become dried, but the tissues of the younger regions, and sometimes the young sex organs, resist the drought; in a surprisingly short time after the first rains, such species mature their reproductive organs. *Sphærocarpus*, growing from spores, appears rather later. Some species of *Fossombronia* and notably *Geothallus tuberosus* survive the dry season by tuber formation, and it is evidently in this condition that *Geothallus* was introduced in soil from San Diego, where the low rainfall apparently seldom induces thallus development from the tubers. The thallose liverworts of this region are either cosmopolitan species or, for the most part, confined to the Pacific coast, and show little relation to the species of the eastern United States. The foliose Acrogynæ are little represented in comparison with thallose types, and their relationships are on the whole rather with European than with species of the eastern United States.

### Fungi of India

THE publication of the "Fungi of India" by Butler and Bisby in 1931 marked the beginning of a period of more exact mycology in India. Records up to the year 1930 were enumerated, and it was only to be expected that during the eight years now past, an imposing number of fresh records would be made. These have been collected by Dr. B. B. Mundkur into a supplementary volume (Imp. Counc. Agric. Res., Sci. Monograph No. 12. Pp. 54. Delhi: Manager of Publications. Rs. 1.6, or 2*s*. 3*d*. 1938). Myxomycetes have been included in the present compilation, and the mycological flora of India now possesses 2868 species—an increase of 517 over those previously published. Plant pathogens and parasitic fungi predominated in the earlier volume, but the extension of mycological work, during recent years, to include studies of soil organisms, coprophilous fungi, and aquatic moulds, is well reflected in the supplement. A new species, *Mycosphærella tinosporæ*, has been constituted in the present account, following the discovery by Ajrekar and Oza of the ascigerous form of *Cercospora tinosporæ* Syd. The fungus flora of India has yielded few novel taxonomic groupings. This is probably due, however, to a gratifying restraint in the evaluation of supposed new forms by those who have prosecuted the work of collecting and tabulating the records, both in the original volume and in the present supplement.

### A Lignicolous Fungus

THE common agaric, *Collybia radicata*, is well known to students of mycology by virtue of the long 'rooting' base to the stipe. Fries pointed out so long

ago as 1821 that the 'root' was connected with a subterranean tree root, and in a recent paper, A. H. Campbell considers its biological effects upon the host (*Trans. Brit. Mycol. Soc.*, 22, Pts. 1 and 2, 151–158; Aug. 1938). The vegetative mycelium produces a white rot in the root of the tree, followed by delignification. Limiting plates are also formed in the wood by the cementing together of cells with a brown substance, very similar to the formation of sclerotia. The fungus can also be grown to yield viable spores in pure culture, and here also, 'averting mycelia' or brown plates are formed if other cultures are reached. The term 'pseudosclerotium' is proposed for such limiting plates.

### Peach Mildew in Egypt

THE peach is the most economically important of stone-fruit trees in Egypt, but its fullest yield is prevented by widespread attacks of the peach mildew fungus, *Sphærotheca pannosa*, var. *persicæ*. Dr. Amin Fikry has investigated methods for the control of this disease (*Min. Agric. Egypt Tech. and Sci. Serv. Bull.*, No. 183, 14 pp. + 7 plates. Gov. Press, Bûlâq, Cairo, P.T.3; 1937). Symptoms of the malady, its distribution, host relations, and the climatic or edaphic factors affecting parasitism, are all described in detail, and are further illustrated by the plates. Lime-sulphur washes, either home-made diluted 1 in 10, or commercial concentrates diluted to 1 in 200, were found to give complete control after three applications, whilst amberene (sodium polysulphide) was also effective. The addition of 0·2–0·5 per cent of soap was found to be necessary, when trees with young fruits were to be sprayed, in order to wet the bloom which appears at this stage. The first appearance of the disease seems to vary according to the height of the Nile flood, but spray treatment must be given as soon as symptoms are noticed.

### The Potato Virus X

ONE of the chief difficulties of research into virus diseases of plants has been to account for discordant and puzzling observations upon the appearance of symptoms caused by a supposedly single or pure virus. The conception of a disease caused by a virus complex or mixture of viruses, is now firmly established, but a monograph of the potato virus X by Dr. R. N. Salaman takes the conception still further, and establishes the existence of at least six strains of this particular virus (*Phil. Trans. Roy. Soc. Lond.*, B, 229, 137–217, Sept. 1938). All strains have particles of similar size, are composed of the same nucleoprotein, and produce inclusion bodies within the tissues of their hosts. They vary in the degree of dilution which they can withstand, and in the severity and type of symptoms they produce upon various hosts. A ten-fold excess of a weak strain over a strong one may lead to the masking of the latter. Several other mixtures are considered and make it possible to explain the appearance of particular types of symptoms. Conversion of one strain to another, involving a loss of virulence, has been established, and it is held that such conversion is a true mutation. Questions of acquired immunity, of the relations of virus particles to genes, and many other problems are further considered. The only anxiety, amongst Dr. Salaman's adequate wealth of detail, is that future classification of viruses should provide an arena for taxonomic "lumpers" and "splitters", but that very detail directs the problem more to the physiologist than to the systematist.

### Recent Large Earthquakes recorded at Stuttgart

THANKS to Dr. W. Hiller, we are able to report that earthquake shocks producing very large amplitudes on the seismograms were recorded at Stuttgart at the following times: 1938, Nov. 5, 8h. 55m. 52·5s., 11h. 2m. 45·5s., Nov. 6, 9h. 6m. 25s., and 21h. 51m. 18·5s., all in G.C.T. The epicentre of the first of these was estimated to be at a distance of 9550 km. from Stuttgart in a direction N. 35° E., and to be probably in the Pacific Ocean fairly near the coast of Japan. The others were probably aftershocks from near the same epicentre, and the first pulses in each case were compressional. The first two shocks showed evidence of some considerable depth of focus, in that the *pP* pulse (that is, a primary pulse from the focus reflected immediately at the earth's surface before proceeding) first recognized by Scrase, was recorded on November 5 at 8h. 56m. 19s., and at 11h. 3m. 20s. All these shocks show correlation with those recorded at Kew Observatory, the depth of focus of the first shock being estimated from the Kew records to be about 75 km., which is considerably below normal.

### Structures of Some Compounds

THE electron diffraction method has been used by K. J. Palmer (*J. Amer. Chem. Soc.*, 60, 2360; 1938) in investigating the molecular structures of some relatively simple compounds. The interatomic distances and angles were calculated. It was shown that sulphuryl chloride ($SO_2Cl_2$), vanadium oxychloride ($VOCl_3$) and chromyl chloride ($CrO_2Cl_2$) have tetrahedral configurations which are, however, considerably distorted. Thionyl chloride ($SOCl_2$) is pyramidal, and sulphur trioxide ($SO_3$) is planar. Sulphur chloride ($S_2Cl_2$) has one chlorine atom attached to each sulphur atom. The S—O distances in $SO_2$ (previously measured by Cross and Brockway), $SO_3$, $SOCl_2$ and $SO_2Cl_2$ are nearly equal and from 0·06 A to 0·09 A. shorter than the sum of the normal double-bond radii, which is 1·52 A. It is concluded that excited electronic structures in which double and triple S—O bonds are present must make a considerable contribution to the normal state of these molecules; these are more important for thionyl and sulphuryl chlorides than for sulphur dioxide and sulphur trioxide.

### Ions in Solution

IN a comprehensive review of the present position of the physical chemistry of electrolytic solutions, by several contributors, recently published (*J. Franklin Inst.*, 225, 623–743; 1938), H. S. Harned describes the thermodynamic aspect as related to the Debye-Hückel theory; this includes a survey of activity coefficients as determined by several independent experimental methods, and the close agreement between these is emphasized. The case of weak electrolytes in salt solutions is included. It is concluded that the development of these methods in the study of equilibria has reached a stage where a reliable and accurate body of evidence is becoming available. The conductivities of aqueous solutions is reviewed by D. A. MacInnes, who discusses the validity of Onsager's equation, which holds accurately

for very dilute solutions, whilst for more concentrated solutions semi-empirical equations are available. Solutions in non-aqueous solvents are considered by C. A. Kraus, who concludes that a solution of the difficult problems in this field will not be found through a mere extension of the limiting laws which hold only at very low concentrations, and that much more experimental work is required. Kinetics in ionic systems is the subject dealt with by V. K. La Mer; the primary salt effect, the secondary salt effect, generalized acid-base catalysis, and the effects of temperature, are the main topics reviewed. The derivation of ionization constants and limiting conductivities from conductivity measurements is considered by T. Shedlovsky. The papers are accompanied by bibliographies.

### Capture of Orbital Electrons by Nuclei

ACCORDING to the Fermi theory of β-ray emission, the electrons or positrons are created at the moment of ejection by a neutron-proton or proton-neutron transaction. Yukawa suggested that an alternative process to the emission of a positron might be the capture of an electron from the outer atom. This process might occur in cases where the energy available was insufficient for positron creation. L. W. Alvarez (*Phys. Rev.*, **54**, 486; 1938) discusses the evidence for electron capture. The capture of an electron from, say, the *K* shell, is followed by the rearrangement of the orbital electrons and the emission of a characteristic X-ray of the daughter element. Soft X-rays of the right absorbability have been observed from the artificially radioactive vanadium isotopes which are formed by deuteron bombardment of titanium. In this case, positrons are also present (probably from the decay of another isotope), and the evidence for electron capture is not quite conclusive as the X-radiation may have been excited in some other way. A more conclusive proof was obtained by studying the activity of a gallium isotope obtained by deuteron bombardment of zinc followed by chemical separation. An electron spectrum from this substance was found to be due to internal conversion of a γ-ray of 100 kv. energy. An X-ray emission was found by absorption measurements to be definitely characteristic of zinc, but no positron emission could be detected and it seems certain that the gallium isotope decays to zinc exclusively by electron capture. The zinc X-rays are then formed by rearrangement of the orbital electrons. The author considers that electron capture processes also occur in the cases of $^{180}$Ta, $^{40}$K, $^{65}$Zn, $^{197}$Hg, $^{106}$Ag, Cd, $^{7}$Be, $^{54}$Mn, and that it explains features of the decay of these artificially radioactive atoms which were formerly unsatisfactorily explained.

### Photographic Sensitivity at Low Temperatures

ACCORDING to the theory of Gurney and Mott, the production of the latent image depends on the photo-electric removal of an electron from a bromine ion into the conductivity band, in which it moves until it is trapped by a region of low potential, the sensitivity speck. In the next stage, positive silver ions move up to the charged speck. This ionic movement should be very slow at low temperatures, and the sensitivity of photographic materials might be expected almost to disappear at very low temperatures. W. F. Berg and K. Mendelssohn (*Proc. Roy. Soc.*, A, **168**, 168; 1938) have investigated the sensitivity of a process emulsion at room temperature, liquid air and liquid hydrogen temperatures. The sensitivity changes little between liquid air and liquid hydrogen—it is of the order of 5 per cent of the sensitivity at room temperature, and considerably higher than would be expected on the Gurney-Mott view. At low temperatures, separate variations of light intensity and exposure time have no effect on the final blackening if their product remains constant—there is no failure of the reciprocity law as at room temperature. It is suggested that at low temperatures the electronic changes only take place, the electrons 'freeze' into the lattice and the ionic movements only occur on warming up. At room temperature the simultaneous occurrence of electronic and ionic movements is connected with the failure of the reciprocity law.

### Ionosphere Radio Waves

WHEN a radio beam of angular frequency ω is propagated upwards and reaches an ionized region having $N$ electrons per c.c. of mass $m$ and charge $e$, each of which collides with a molecule on the average $\nu$ times a second, and the region is the seat of a magnetic field $H$, the beam is split up into two, which travel with different velocities and are polarized and absorbed differently. The beam less influenced by the magnetic field is known as the ordinary and that more influenced as the extraordinary beam. The calculation of the polarization of each beam, and the refractive index and absorption of the medium for it from ω, $N$, $m$, $e$ and $\nu$ is a laborious process, and Prof. V. A. Bailey, of the University of Sydney, four years ago devised a graphical method of reducing the labour. In the supplementary number of the *Philosophical Magazine* of November, he describes, in co-operation with Prof. J. M. Somerville of Armidale University College, New South Wales, a numerical method of computation which is very rapid. They calculate first the polarization, then the refractive index and finally the absorption. They introduce three subsidiary functions which enable them to give the calculations on a page of the journal for the ordinary and extraordinary beams due to two incident beams.

### Law of Error

IT has been wittily remarked that mathematicians accept the normal law of error because they believe that it has been proved by experiment, while experimenters believe that it has been proved by mathematics. A searching criticism of both bases of support has been given by Dr. H. Jeffreys (*Phil. Trans. Roy. Soc.*, A, **237**, 231; 1938). The mathematical proof rests on the hypothesis that the error of any individual observation is the resultant of a large number of comparable and independent observations. Even if this hypothesis is accepted, it is not proved that the result applies to errors of any magnitude. As for the experimental facts, Karl Pearson long ago showed that there are substantial departures from the normal law. Dr. Jeffreys confirms this by a very detailed examination of seven sets of observations. He arrives at the important conclusion that the true law governing errors in astronomy and physics is not the normal law, but one of the Pearson type $y = k(1 + x^2/2m\sigma^2)^{-m}$, with the index $m$ between 3 and 4. The effect of the change is to increase the probability of occurrence of large random errors. It appears that a number of discrepancies in experimental readings that have been reckoned as systematic are, after all, possibly merely random.

# Commemoration of the Discovery of Radium

WITH the "Semaine internationale contre le Cancer", which took place at Paris between November 23 and 30, the fortieth anniversary of the discovery of radium by Pierre and Madame Curie was commemorated. Simultaneously, the discovery of the electron, the X-rays, and Hertzian waves was celebrated. The importance of recent discoveries, which are now occupying the attention of contemporary workers, is easily over-estimated; and, making due allowance for this possibility, we feel justified in considering the discovery of radium to be one of the outstanding events of the history of science. It promoted to a higher degree than any other discovery the development of the science of radioactivity, which has so deeply influenced our outlook on the nature and formation of the chemical elements, and simultaneously supplied a tool of outstanding importance alike to various branches of science and to medicine.

France is rightly proud of a great son, French by birth, and a great daughter, French by adoption, and has solemnly commemorated the fortieth anniversary of the discovery of radium. The opening of the "Semaine internationale contre le Cancer" took place at the Sorbonne. The broadcast of the President of the Polish Republic from Warsaw, in which the memory of the great daughter of Poland and her achievements were recalled, was eloquently answered by M. Lebrun, President of the French Republic. Among those present were also Mme. Dluska, the sister of Mme. Curie, and the latter's daughters Irène and Eve, Miss Johanna Hertz, daughter of the late Heinrich Hertz, and the Marchesa Marconi.

The gathering was also addressed by various representatives of the French Government, and on scientific topics by Jean Perrin, Maurice de Broglie and Langevin, who gave a short survey of the physics of the electron, the X-rays and Hertzian waves respectively, while Gutton described the technical application of the Hertzian waves, and Gendrean gave an eloquent description of the life-work of Pierre and Marie Curie.

The addresses delivered on the following days dealt with biological and physical topics, with the exception of that of Rowntree, who discussed the efforts made in Great Britain in cancer therapy. Schinz discussed the possibilities and limits of the treatment of cancer by use of various radiations. The utilization of biological reactions in measuring X-ray doses was the subject of a lecture by Carter Wood, who has found in the eggs of *Drosophila* the most suitable biological material. The application of radioactive indicators in biology was discussed by Hevesy, that of the electron microscope by Marton, while Errera spoke on the effect of Hertzian waves on macromolecules. Bernal's lecture dealt with the elucidation of the structure of the virus by the use of X-rays. Several physical topics were discussed as well. The only surviving assistant of the late Heinrich Hertz, Prof. Bjerknes, gave an illuminating survey of Hertz's work. Louis de Broglie gave a lecture on the wave character of the electron, followed by G. P. Thomson, who discussed the phenomena of electron diffraction and its applications. Several lectures dealt with technical topics, including a lecture by Bouwers, who discussed the production of different kinds of penetrating radiation, mentioning the construction of a sealed X-ray tube at Eindhoven operated at one million volts.

The lectures were given at the Palais de la Découverte, which contains such a wealth of exhibits showing the trend of scientific progress in the most diverse fields in an unsurpassingly inspiring and instructive way—a fitting frame for the celebration of the fortieth anniversary of the discovery of radium.

G. H.

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# The Imperial Bureau of Dairy Science

IN 1936 the British Commonwealth Scientific Conference which met in London to consider the working of the organizations controlled by the Executive Council of the Imperial Agricultural Bureaux, recommended that a new Imperial Bureau of Dairy Science be established. The conference also suggested the National Institute for Research in Dairying as the most suitable place for the Bureau.

Following agreement by all the authorities concerned, the new Imperial Bureau of Dairy Science has now been established at Shinfield, near Reading. Prof. H. D. Kay, director of the National Institute for Research in Dairying, has been appointed director of the Bureau. Mr. W. G. Sutton, from Massey Agricultural College, New Zealand, has been appointed deputy director and has now taken up his duties. The Bureau is financed co-operatively by the Governments of the British Empire in the same way as the other Imperial Agricultural Bureaux.

The functions of the Bureau are to index research work in dairy science, whether carried out in the Empire or elsewhere; to collect, abstract and collate information bearing on dairy science and to distribute such information both by publication and by private communication to research workers, officials and advisory officers throughout the Empire. In addition the Bureau is charged with the duty of establishing and maintaining contact between research workers with common interests, promoting conferences of workers and visits to research centres, and in general encouraging the circulation of information, ideas, material and personnel.

The field of dairy science to be covered by the Bureau was defined by the Conference when recommending its establishment. This field includes the microbiology, chemistry and physics of milk and its products; animal diseases in so far as they affect milk and its products; the technology of processing milk and manufacturing dairy products; the

physiology of milk secretion as affecting quality and quantity of milk and dairy products; standards for the composition and quality of milk and its products.

The routine duties of the Bureau, such as indexing and abstracting, will already be familiar to many dairy workers from the activities of the Bureaux already established in other subjects. An aspect of Bureau work which may not be so well known and understood is the more informal service which can be given to research workers, teachers and field officers. The Bureau will deal directly with the individual workers in dairy science, who are invited to write to the Bureau for information which is not obtainable in their own countries. The Bureau may be able to supply the information itself, or to put the inquirer in touch with someone who can do so more effectively.

The new Imperial Bureau of Dairy Science has been established in answer to requests for a clearing house for information in dairy science; its value to dairy science, and to the dairy industry generally, will largely depend on the extent to which research workers and others avail themselves of its services.

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# Algeria To-day

A SERIES of illustrated books on Algeria and its institutions, published during the past two years by the Gouvernement Général de l'Algérie, Algiers, coupled with a recent visit to the country, has prompted the following notes.

Algeria is a land of contrasts. The co-operation of two widely different races and faiths, over a century of steady progress, has turned a land which was dreaded in the past for the daring of its pirates into a country where agriculture, social conditions, art and learning are developed to a high degree.

Owing to its excellent organization, its importance as a capital and to its easy accessibility, Algiers is often the venue of international meetings dealing with technical problems, such as the production of wheat, wine, minerals, or again civil engineering, industrial chemistry, anthropology, archæology and medicine. Such occasions provide excellent opportunities for scholars and technicians to see a good deal of the French North African provinces.

Algiers itself is worth a thorough visit. East and West meet in that ancient capital of the deys, whose palace still dominates the white agglomeration of the Kasbah. But the European town itself has grown considerably, thanks to an enlightened policy of public works which have really placed it among the most modern towns of the Mediterranean[1]. What adds to the interest of Algiers, besides its museums, botanic gardens and well-equipped hospitals, is its fully organized University, which, for the past twenty-five years, has been the centre of the intellectual life of the country. The faculty of arts, which includes a newly formed department of philosophy under Prof. Mesnard; the faculty of science, with its well-appointed laboratories, such as that of industrial physics under Prof. Verain; the faculty of laws, which is particularly important owing to the existence of two legal systems in the country, and the faculty of medicine, with its up-to-date hospitals and medical research stations—all are very active and occupy an eminent rank in higher education, thanks to the results obtained in all fields by its professors and research workers. In spite of the economic crisis and the difficulty experienced by students leaving the University in obtaining posts, an average of about 2,500 students of both sexes are registered in each year.

If Algiers has the only university of French North Africa, there are three higher colleges of Moslem civilization, the Medersas of Algiers, Constantine and Tlemcen. But it should be mentioned that only a small percentage of the Algerian native population receives any education at all. There are not sufficient schools to meet the demand for elementary education for native children, in spite of the efforts of an administration hampered by lack of funds. This can be inferred also from the large number of children in the streets and lanes, especially in the villages of the south.

It must be said to the credit of the authorities, however, that they spare no efforts to improve the situation[2]. But they are not always helped by the natives, as some of them are apt to consider official education as an attempt to interfere with their religion and customs, and with the authority of the parents over their children; while others prefer to use their boys and girls for domestic or farm work. In spite of this, there are roughly 60,000 boys and 6,000 girls in the 800 native elementary schools; against about 75,000 boys and 75,000 girls in the European elementary schools. It is interesting to note also that there are about 2,900 Koranic schools in Algeria, with about 44,000 pupils.

Technical and agricultural instruction is given to boys in a few up-to-date institutions, which have about 3,000 pupils, one fourth of whom are natives. The girls are taught domestic economy, carpet-weaving and embroidery in various institutions supervised to a large degree by religious orders, such as the famous Pères Blancs and Sœurs Blanches, the apostles of the desert. There are also professional training centres: a pottery-school, a ceramic school and a wool-craft centre. The Algerian arts and crafts centres of the town of Tlemcen have a high reputation in North Africa: a magnificent saddle embroidered with gold, which was made at these centres, was presented to the King of Egypt on the occasion of the recent Cairo exhibition.

Though Algeria is not regarded as an industrial country, it offers a wide field for agricultural study and experiment. The northern plains and high plateaux offer excellent opportunities for farming: cereals, vineyards, vegetables, olive oil, tobacco, cotton and wool are produced in great quantities. They compete on the French market with the home produce, and often cause friction between Algerian and French interests—a sore point for the administration of both countries. It may be worth mentioning here that, after France and her colonies, the United Kingdom's trade with Algeria is more than double that of any other country: Algeria imports about

one million pounds worth of goods from England, and exports about 1·25 millions in value.

The development of the oases of the south have opened up the desert, so to speak, to regular exploitation. Owing to lack of water, this policy of development has to be slow. But the results already obtained between Touggourt and Biskra, along the Oued R'ir, are most promising. The co-operation of the local proprietors, such as the Cheikh El-Arab ben Gana, who is the head of all the Arabs of North Africa, is an invaluable asset for the progress of the country. As things stand at present, there are most interesting comparisons to make from this point of view, with the methods used in Irak, Egypt and Libya for the exploitation of the desert belt of North Africa and Asia Minor.

Algeria is of great importance for the historian and the geographer. The imposing ruins of Timgad and Djemila[3] are an epitome of Roman history, and a testimony to the genius and power of Rome[4]; while Islamic civilization has left lasting marks throughout this rich land[5]. A curious experience is offered by the M'zab country, the home of the Puritans of Islam, who fled right into the desert to escape the persecutions of the orthodox Moslems, and founded there the interesting towns of Ghardaia and Guerrera and other villages, where they keep intact their religious laws and customs[6].

Then there is the unique experience offered by the Sahara, which is now open to regular traffic from one end to the other[7]. The geography, geology, flora and fauna of this vast tract of land are now objects of systematic study. Among the most notable achievements of French scholars in this field of research are the results obtained by Prof. Reygasse, head of the Anthropological Museum of Algiers, during his expeditions in the fastnesses of the Hoggar, the land of the Tuaregs. There he discovered distinct signs of a primitive civilization, which was mentioned by Herodotus. The carvings and rock paintings, some of them twenty feet high, which he discovered in the Hoggar mountains, that rise to more than 8,000 feet, are among the most precious specimens of primart.

T. GREENWOOD.

[1] "Algérie 1937". By various authors. Pp. 184.
[2] "Pour comprendre l'Algérie". By René Lespès. Pp. 219. (1937).
[3] "Djemila". By Louis Leschi. Pp. 40. (1938.)
[4] "L'Afrique Romaine". By Eugène Albertini. Pp. 70. (1937.)
[5] "L'Algérie Terre d'Art et d'Histoire". By A. Berque. Pp. 369. (1937.)
[6] "Ghardaia la Mystérieuse". By Marcel Mercier. Pp. 391. (Algiers Soubiron, 1932.)
[7] "Le Sahara Algérien". By Léon Lehuraux. Pp. 64. (1937). (Algiers: Gouvernement Général de l'Algérie.)

# Future Developments in Coal Treatment and Utilization

THE future of coal is of interest in some form or another to modern industries of all kinds, but is of special interest to the technicians and industrialists of the Tyneside area. This gave special importance to the symposium on "Future Developments in Coal Treatment and Utilization" arranged by the Newcastle-on-Tyne Section of the Society of Chemical Industry at King's College, Newcastle-on-Tyne, on December 7 last. The papers dealt with quite different aspects of fuel technology, and the change of point of view of the speakers was stimulating where a similar series of papers all on the same lines might have been tiring.

The papers by Dr. W. T. K. Braunholtz and by Dr. E. W. Smith can be considered together. The first was a careful survey of the growth of research in the gas industry from the early days of individual effort to the organized research of to-day which embraces all subjects of interest to the industry, from retort refractories to ammonia recovery. The organized work of to-day is in the hands of the Institution of Gas Engineers and of the collaborating organizations. Dr. Braunholtz directed attention to the important effect of former researches and hinted that the future might witness remarkable advantages in the technology of gas production. He was referring, no doubt, to the Institution's researches at the University of Leeds on the complete gasification of coal or coke with hydrogen under pressure. He visualized a future in which our domestic fuels will all be fluid, stating that the open grate must eventually disappear. Although Dr. Braunholtz may be right, it must be said that, at the moment, the development of smokeless fuels is actually stimulating interest in the open grate.

Dr. E. W. Smith took up the story where Dr. Braunholtz left off, but treated the subject more from the economic point of view. He started by postulating the importance of administration, without which research cannot properly serve its intended purpose. Dr. Smith considers that there will be no radical change in the technique of carbonization either in the coking or gas industries for some time, although a steady evolutionary advance will be made in matters of detail. He considers that the future tendency of the carbonizing industries will be towards increasing flexibility, and pointed out that an all-gas policy does not make for overall efficiency. He prefers that flexibility which is derived from a variety of products, and as one example in gas manufacture pointed out that the yield of coke for sale could be increased by as much as 143 per cent if coal gas were used for retort heating so as to liberate coke for sale. This very great potential increase in the production of coke has seldom been realized.

As regards the relations of the two industries, it is obvious that even closer co-operation should be brought about in order to utilize properly the coke-producing capacity of coke-oven plants, when metallurgical coke is not being made, and the capacity in the gas industry, and also to overcome the difficulty of discontinuity in the supply of coke-oven gas to other industries.

The paper by Dr. J. G. King struck an entirely different note. Pointing out that the properties of coals are still not fully known, the author gave a variety of examples to show where a greater knowledge of these properties may not only influence the preparation of coal for the market and its use in

existing industries, but may also indicate new markets. Thus a study of the physical structure of coal can give assistance in coal mining and coal breaking problems, in the dedusting of fine coal and in coal cleaning. It has already been shown that the nature and extent of the bands, partings and cracks in lump coal can be examined radiographically before and after the adsorption of lead salts, and that a study of microstructure can aid in the selection of coals for the production of active carbons in which the original structure of the coal is retained.

Dr. King pointed out the importance of the changes which occur in coal on heating, to the carbonization and other industries, and admitted that we are still very ignorant of the true meaning of these changes. A greater knowledge, he said, would greatly help coal blending and the precise selection of coals for special purposes such as complete gasification and the motor-lorry gas producer. Although research on the chemical constitution of coal has not yet achieved its object, Dr. King feels that new lines of attack should be tried; previous work has already indicated new processes such as the production of ash-free coke by the Pott-Broche process and the production of base-exchange agents by the action of sulphuric acid. The paper stimulated a lively discussion in which many and diverse points were touched upon. It seemed to be generally agreed that the proper utilization of coals would be furthered by the close definition of their fundamental properties.

The paper sponsored by Prof. A. C. G. Egerton detailed one important aspect of the properties of coal, namely the part played by its sulphur content. Since the utilization of high-sulphur coals may be one of our future problems, it is desirable to know now how the sulphur can be controlled. Mr. Armstrong (research student from South Africa) detailed experiments on the partial elimination of sulphur from coke by passing various gases through the coal during carbonization in the presence of inorganic substances. The reductions are quite marked in some cases with steam, hydrogen or ammonia; but inert gases have little effect.

The sulphur problem attracted some discussion from the steel technologists present, it being pointed out that a decrease of 0·1 per cent in the sulphur of coke would represent a saving of 1*s.* per ton in the cost of pig iron.

On account of the high cost involved, the production of motor-spirit and oil from coal has not greatly increased in Great Britain, but considerable strides have been made in the technical sphere. Dr. R. Holroyd described some of the important advances which Imperial Chemical Industries Ltd. have made in connexion with the control of the chemical composition and octane number of the motor-spirit. Three types of catalyst are now available for the vapour-phase stage of the process so that cracking, hydrogenation and isomerization reactions can be controlled to give motor-spirit of the composition necessary for high knock rating. Thus spirit can be made with a very high aromatic and low normal-paraffin content; this has a high octane number (80) but a low susceptibility to lead tetraethyl (4 ml. per gall. raises the octane number to 86–7). Alternatively, spirit rich in branched-chain paraffins and low-boiling naphthenes can be made; this has a lower octane number (75–6) but a much higher susceptibility to lead tetraethyl, since 4 ml. per gallon raises the octane number to 89–90. Dr. Holroyd said that when similar control has been established over the liquid-phase stage the hydrogenation process will have more control over its products than the oil industry.

Although not the last paper of the evening, Captain J. G. Bennett's paper really constituted a final word on coal utilization. By assessing the items influenced by the type of fuel, such as overheads, maintenances, repairs, etc., he was able to demonstrate mathematical relationships between the "figures of merit" for fuels, these figures of merit being technical efficiency, economic efficiency and psychological merit. For the three types of energy, coal, gas and electricity, a ternary diagram may be constructed. Although his proposals are still not fully developed, Captain Bennett was able to show how this diagram can be used for the analysis of statistical and operating data referring to fuel problems; the trends in costs can be followed and the appropriate fuel chosen for any particular purpose. The proposals attracted considerable interest, although it was thought that the large number of variables would make the calculation difficult and might impair accuracy.

## Scientific Research and Industrial Needs in Canada

IN a recent address to the Canadian Chamber of Commerce, Major-General A. G. L. McNaughton dealt with those activities of the National Research Council that serve to enlarge the demands of industry for the produce of farms, fields and factories. At present, Canadian industry draws about 12 per cent by value of its raw materials from agriculture, or about one third, if forests be included. He referred to recent progress in the United States, where four large research institutes, each endowed with an annual revenue of a million dollars, have been established; and he laid special stress upon German progress in the same direction under the four-year plan. Whereas about 45 per cent of the annual cut of wood was formerly used for low-grade fuel, now 95 per cent is consumed by industry, and Germany is striving to replace iron and steel for construction work by synthetic resins derived from wood and agricultural products. If Canada is to survive, said General McNaughton, she must follow the same path, for the old-time one-product system of farming is becoming unremunerative in view of the growth of national self-sufficiency in Europe.

At the same meeting, Dr. C. Y. Hopkins outlined some of the chemical problems now being studied in Canada with the above object in view. China wood oil has of late been replacing linseed oil in varnishes and enamels, and the production of flax-seed in Canada has much diminished; hence efforts are being made to find a satisfactory alternative either by chemical modification of China wood oil or by breeding a new variety of oil-seed that could be cultivated in Canada. A home-grown substitute for the vegetable oils now largely imported for soap-making is also

being sought. Among the *faits accomplis* of Canadian chemists may be mentioned standardization of tests for honey, improved maple products, a method of drying apples and other fruits with better retention of flavour, and a wax mixture for use in plucking poultry.

Dr. N. H. Grace dealt with projects and achievements in the field of biology. Growth-promoting substances are now added to the dusts used for disinfecting seeds. The development of rust-resistant varieties of wheat is estimated to have saved the prairie provinces about 38 million dollars this year. Research is proceeding on the factors that determine the malting quality of barley with the view of growing more barley of better quality. In 1937, some 80,000 tons of bacon were sent to Britain, prepared in twenty-six plants, each using its own method; research is now being directed towards improving both quality and uniformity.

Methods have been developed for altering the heritable characters of plants by heat and chemical treatment, and progress in producing a drought-resisting and soil-binding forage crop for western Canada has been effected by crossing a Russian grass with the best Canadian wheat varieties. From poplars and conifers it is hoped to produce, by crossing, rapid-growing varieties of trees possessing hybrid vigour and disease-resistance that may be vegetatively propagated with the aid of 'plant hormones'.

## Admiralty Laboratories at Sheffield

THE new Admiralty Laboratories at Janson Street, Sheffield, were opened on December 15 by Sir William Bragg, president of the Royal Society.

These laboratories, which have been constructed to cope with the ever-increasing amount of Government work, are designed in such a fashion as to incorporate all recent developments in laboratory architecture. The two large analytical laboratories, for ferrous and non-ferrous analysis respectively, embody many unusual features. One was struck with the arrangements which have been made for the conducting of chemical analysis on a large scale; indeed the expression 'mass-production' might be used with respect to the systematizing of analytical methods, certain benches, for example, being given up solely to determinations of one particular element. The carbon combustion room was particularly intriguing in its lay-out, containing several combustion apparatus all set in a line and arranged for rapid analysis of carbon in steel. A particular feature is made of spectrographical analysis, for which purpose Hilger quartz spectrographs are used. This method of analysis has been brought to a high state of efficiency, and complete reliance can be placed on the results obtained.

One was particularly impressed not only by the orderly and systematic arrangement of plant and apparatus, but also by the system with which the work is carried out; even the chemical store is a model of order and forethought. The heat-treatment laboratory, containing Birlec and Wild-Barfield high-temperature furnaces with temperature control devices, supplies all that is required for experimental heat-treatment purposes, and it is understood that a high-frequency furnace is shortly to be installed. One of the most pleasing features is the lighting, the lower half of the windows being of Thermolux glass, which provides insulation from both heat and from the glare of the sun, whilst the walls of the laboratories are of a very pleasing tone of semi-glazed fireclay tiles. The air-conditioning system is novel, and no signs of fumes can be detected anywhere in the laboratories.

These new laboratories are capable of turning out all the work that is necessary, and their constructional arrangement has considerably speeded up the rate of analysis. They are most pleasing premises to work in, and those in authority are to be congratulated on this new development, which is significant of the scientific progress in metallurgical work for which the Admiralty has been responsible in the past.

J. H. A.

## British Institute of Radiology

### Annual Congress

THE twelfth Annual Congress of the British Institute of Radiology was held in the Central Hall, Westminster, on December 7–9, and in connexion with the Congress there was an exhibition of apparatus organized by the British X-ray industry. The Congress was opened by the president, Mr. W. E. Schall, the opening address being followed by the nineteenth Mackenzie Davidson Memorial Lecture, delivered by Dr. G. Shearer on "X rays—Their Influence in Pure and Applied Science". In the course of this lecture, Dr. Shearer noted that twenty-five years have elapsed since Moseley first observed the regularities in the $K$ and $L$ X-ray spectra of the elements which pointed to the general similarities in the internal structures of various atoms and led ultimately to a fairly complete understanding of atomic structure and to the placing of electrons in their appropriate energy levels. This same series of observations has also led to the use of X-rays in the study of the solid state, with results of great practical and industrial importance. From the study of simple crystals by W. H. and W. L. Bragg, the work has advanced to such an extent that complex molecules such as the proteins can now be studied, and the results, incidentally, linked up with the work of the organic chemists. Another phase of X-ray work

entailed the study of materials from an industrial point of view, and in many cases the physical properties of materials can be correlated with the size and perfection of the individual crystalline components, while the X-ray method is the method of choice in investigations into the phase relations in alloy systems.

The physical papers dealt with certain lesser-known uses of radiations. F. I. G. Rawlins gave a paper on "X-rays in the Study of Pictures", dealing with the work carried out, largely at the National Gallery, on the X-ray study of the works of various old masters. He showed how, using radiation excited at very low kilovoltages (about 10 kv.), the lower structures of paintings could be revealed and the existence of alterations and restorations detected. In many cases, such studies have served to verify the traditional histories of the pictures. Dr. F. G. Fraser outlined the X-ray work of the British Museum (Natural History) in his paper on "Radiography in Zoological Research". He pointed out how the complete study of the skeletal structures of specimens too rare to be subjected to ordinary anatomical dissection was often helpful in placing animals in their correct zoological classifications.

A different type of investigation was considered by L. G. Nickolls in his paper on "The Use of Invisible Radiation in Police Work". This was mainly concerned with the use of ultra-violet and infra-red radiations in the detection of forgeries and overprinting in documents and identifying the positions of various stains on materials. As regards forgeries, etc., Mr. Nickolls pointed out that, from the point of view of criminal detection, it is important not only to establish the presence of alterations but also to read the words which have been erased. In order to do this, it is important to photograph the document in such a way that the background disappears. This can often be done by means of light in various selected wave-lengths, and certain bands in the ultra-violet region have proved of great use. Similarly, infra-red radiation serves to reveal marks embedded in the lower fibres of paper. As special cases, examples of frauds connected with motor-car licences and with stamps were given. The characteristic fluorescence of practically all physiological fluids under ultra-violet light sometimes served to identify their presence, but more usually fluoroscopic examination is used to reduce the areas to be examined by the more chemical methods.

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## Science News a Century Ago

### Royal Astronomical Society

AT the December 1838 meeting of the Royal Astronomical Society, several communications were made. The first of these was an extract of a letter from Bessel to Sir John Herschel alluding principally to the means which he had employed to ascertain the effect of temperature upon measurements made with the heliometer, which consisted in observing such of the stars in the Pleiades as were visible in the coldest winter, by night, and in the warmest summer, by day. "At the approaching disappearance of Saturn's ring", he also wrote, "sufficiently powerful telescopes will probably show *all* the satellites of the planet. I believe that large reflecting telescopes will begin to supersede achromatic ones; at least, I have no doubt they are capable of greater perfection. They can be made with mathematical precision, which is not the case with achromatic telescopes. I think also that opticians would have devoted their attention to them in preference, if they had not been discouraged by their more rapid destructibility. If the method of making an indestructible *metallic* surface could be discovered, I should no longer doubt of a still further perfection of the reflecting telescope. Could not *hard* steel be made available? and would it not, if proper care was taken of it, be less destructible than the common metallic reflector?"

The other communications included one by the Rev. R. Main on "Errors of Heliocentric Longitude and Ecliptic Polar Distance of the Planet Venus"; another from Airy, the Astronomer Royal, "A Catalogue of 726 Stars reduced to the Year 1830; and deduced from the Observations made at Cambridge in the years 1828–35"; an extract from a letter from Henderson to Baily relative to the eclipse of the sun on May 15, 1836; and also an extract from a letter of Lassell to Sheepshanks relative to observations made with a small sextant. The instrument was of only 3 in. in radius and was by Dollond. Lassell had made observations on various stars for time and latitude for the express purpose of determining how near to the truth he might be able to approximate by its means. He found that in ordinary circumstances, the mean of one set of altitudes east and another west, would give the time truly within one second, and that a set of each north and south, at something like equal altitudes, would give the latitude within eight or ten seconds.

### Armstrong's Improved Water Wheel

WILLIAM GEORGE ARMSTRONG, afterwards Lord Armstrong, who was born in 1810 and died in 1900, was trained as a lawyer, and it was not until 1847 that he joined the small firm which was developed into the famous Elswick Works. Armstrong first obtained success as a maker of hydraulic machinery.

Armstrong's attention had been directed to the use of water-power in 1838, and the *Mechanics' Magazine* for December 29 of that year contained a contribution from him entitled "On Hydraulic Power". In this he referred to the limitations of the overshot water-wheel and the need for an appliance for utilizing the head of water from streams in hilly districts. The first step he considered necessary was to confine the water within a pipe. It was, he said, extremely important that the motion of the water through the pipe should be slow, "otherwise much of the force of gravity would be expended in the production of motion, and the power exerted in the machinery would in consequence be greatly diminished" He had heard that machinery with cylinders and pistons had been used, but to these there were objections. He then described and illustrated an apparatus suitable for the purpose. In this the water flowed through a tube formed into a semicircle. The inside circumference of the semicircle was slotted. A horizontal axis carried a wheel with an edge rim which revolved in this slot. The edge rim of the wheel had four circular apertures, fitted with disks, which would just pass through the pipes. The water acting in turn on these disks caused the wheel to revolve. Curiously enough, Armstrong did not mention the use of the hydraulic turbine of Fourneyron.

# Societies and Academies

## Paris

Academy of Sciences (*C.R.*, **207**, 1021–1076, Nov. 28, 1938).

M. MOLLIARD, R. ÉCHEVIN and A. BRUNEL. Nitrogen composition of variegated leaves. The amount of nitrogen (total and also as protein, nitrate, etc.) increases with the extent of variegation. A similar increase in nitrogen content occurs in radish grown in aseptic culture under increased oxygen pressure.

S. MAZUR: Linear rings.

B. KWAL: Some relativistic generalizations of fundamental equations of analytical mechanics.

G. BADARAU: Passage and diffusion of corpuscles through Coulomb potential barriers.

A. GUILLET: Simultaneous determination of resistance, current and electromotive force in absolute electromagnetic units, ohms, amperes, volts.

L. TISZA: Thermal superconductivity of liquid helium II and the Bose-Einstein statistics.

M. VÉRON: Combustion and detonation in a combustible gaseous mixture maintained at constant volume.

A. GOLDET: Measurements of indexes of refraction in the ultra-violet. A total reflection refractometer was adapted for the purpose.

Y. TA: Effects of radiations on pyro-electric crystals: possibility of their utilization as detectors of infra-red radiation.

E. MOLES, MLLE. M.-T. TORAL and A. ESCRIBANO: The limiting density and molecular weight of ethylene; new revision of the atomic weight of carbon. The molecular weight of ethylene is $28{\cdot}046 \pm 0{\cdot}001$; atomic weight of carbon is $12{\cdot}007 + 0{\cdot}000_8$, identical with Aston's mass-spectrographic value.

W. HELLER: Structure of non-thixotropic gels with hydrophil particles.

E. CARRIÈRE and MLLE. R. LASRI: Study of the precipitation of barium molybdates as a function of *p*H.

L.-G. SABROU and E.-M. RENAUDIE: Formation of asphaltic products visible under the microscope during the ageing of lubricating oils.

P. GAUBERT: Mobile rings in anisotropic drops of *p*-azoxyanisol containing a small quantity of phloridzine.

P. BELLAIR: Heavy [petrological] elements in desert sands.

ST. GHIKA-BUDESTI: Petrographic character of the eruptive series of Jebel Sarro (Moroccan Anti-Atlas).

A.-P. DUTERTRE: The Lower Albian of the Boulonnais.

F. TANAZACQ: Discovery of a fossiliferous horizon in the French Ardennes in the slate massif of Rocroi.

L. BERTHOIS: Deposition of sediments in the western Mediterranean. The greater part of the detritic elements do not extend beyond a narrow coastal band; thus sediments accumulate very slowly.

C. BOIS: The torrential rains in Tunisia. The maximum recorded is 231 mm. in 24 hours near Téboursouk. Rainfall data for thirty stations are given.

MLLE. B. BIECHELER: The chromatic cyclosis of peridians is a stage (prophase-metaphase) in their division.

A. SARTORY, J. MEYER and D. SCHMUTZ: Study of the relation between the dose of heterogeneous water-soluble vitamin and the quantity of bacteria initially implanted, by control of the activation of growth.

G. VALETTE and R. ROLLÉ: Action of quinine on amœbæ: cellular penetration and toxicity.

M. RANGIER and P. DE TRAVERSE: Urinary scatol red.

M. PAIĆ: Determination of the sedimentation constant of hæmolysin.

## Dublin

Royal Irish Academy, November 14.

WINIFRED E. FROST: Larval stages of the euphausiid *Thysanopoda acutifrons* (Holt and Tattersall) taken off the south-west coast of Ireland. Material collected at a deep-water station off the south-west coast of Ireland included sixteen specimens of larval Euphausians unlike any previously described. It was concluded that the larvæ belonged to the species *Thysanopoda acutifrons* (Holt and Tattersall). Four larval stages were represented, and these are described.

November 30.

COLIN B. REES: Notes on the ecology of the sandy beaches of north Donegal. The macrofauna obtained at forty-three stations, which were distributed over eight beaches, is listed. The effect of the tide, as shown by the zonal distribution of the species, the exposure, the salinity of the sea water, the presence of black sand and the sand grade is discussed. Higher numbers of some species were obtained in the finer sands.

## Vienna

Academy of Sciences, October 27.

E. JUSA and R. STECKLER: Formation of thioindigo dyes from isomeric 2-naphtholmonothioglycol acids.

E. SPÄTH and F. VIERHAPPER: Coumarines of the drug *Semen Angelicæ*.

F. WESSELY and F. PRILLINGER: Catalytic hydrogenation of isoflavones.

E. JUSA and B. HÖNIGSFELD: Azo dyes from 2-naphtholmercaptans and 2-naphtholthiomethyl ethers.

G. MACHEK: Derivatives of pyridine-3-sulpho acid.

## Washington, D.C.

National Academy of Sciences (*Proc.*, **24**, 407–495, Oct. 15, 1938).

H. DE TERRA: Preliminary report on recent geological and archæological discoveries relating to early man in south-east Asia. (See NATURE, **142**, 275; 1938).

L. R. BLINKS and R. K. SKOW: (1) The time course of photosynthesis as shown by the glass electrode, with anomalies in the acidity changes. The electrode is placed in direct contact with the tissue or a layer of cells settled from a suspension; thus *p*H changes due to carbon dioxide assimilation are very prompt. Immediately on illumination, an 'acid' gush occurs, followed by regular increase of alkalinity due to assimilation. The effect is discussed. (2) The time course of photosynthesis as shown by a rapid electrode method for oxygen. The principle of the dropping cathode was utilized, substituting bright platinum for mercury. An 'oxygen gush' occurs on illumina-

tion, comparable with the 'acid gush' referred to above; on darkening, however, the oxygen content instantly falls.

W. J. V. OSTERHOUT and S. E. HILL: Reversal of the potassium effect in *Nitella*.

J. BONNER and E. R. BUCHMAN: Syntheses carried out *in vivo* by isolated pea roots (1). Isolated pea roots seem to synthesize vitamin $B_1$ from a mixture of its pyrimidine and thiazole components; a specific enzyme (thiaminase) seems to be involved. Another distinct and also specific enzyme (thioazolase) seems to be necessary to produce the vitamin thiazole required.

C. E. MCCLUNG: Chromosome phylogeny. A discussion leading to the view that the linear order of the elements of the chromosomes represents the addition of parts to meet the growing complexity of higher forms, that this is connected with a temporal sequence and that, in the reaction system which constitutes the cell, one chromosome establishes a balance in relation to the others which is determinative in shaping the characters of the body.

B. H. WILLIER and MARY E. RAWLES: Feather characterization as studied in host-graft combinations between chick embryos of different breeds. Feathers in a graft area are produced by the host feather germs, but their colour or pattern is under the control of the graft.

K. W. COOPER: Concerning the origin of the polytene chromosomes of Diptera. Growth of the tissues, which is largely by increase of size of cells rather than increase of number, is related to growth in number of chromonemata occurring in these large chromosomes; possibly the nuclei prepare for prophasic condensations which by some means are prevented from occurring.

F. B. SUMNER and P. DOUDOROFF: (1) Some effects of light intensity and shade of background upon the melanin content of *Gambusia*. Melanin content of the mosquito fish is correlated with brightness of the background to which it is subjected for some weeks. (2) Effects of light and dark backgrounds upon the incidence of a seemingly infectious disease in fishes. Its incidence was highest in black bowls, and is possibly due to the same agency as that which affects the melanin.

M. HERZBERGER: Theory of transversal curves and the connexions between the calculus of variations and the theory of partial differential equations.

G. A. MILLER: Relative numbers of the subgroups and operators of certain groups.

J. L. WALSH: Interpolation and approximation by functions analytic and bounded in a given region.

K. MENGER: A new foundation of non-Euclidean, affine, real projective and Euclidean geometry.

J. DOUGLAS: A Jordan space curve having the infinite area property at each of its points.

## Appointments Vacant

APPLICATIONS are invited for the following appointments, on or before the dates mentioned:

LECTURER IN CHEMISTRY in the Kingston-upon-Thames Technical College—The Principal (December 31).

LECTURER IN PHYSICS AND CHEMISTRY in the Barbados—The Secretary (I.P.R./C.A.), Board of Education, Whitehall, S.W.1 (January 2).

ORGANIZER OF AGRICULTURAL EDUCATION in West Suffolk—The Chief Agricultural Officer, Shire Hall, Bury St. Edmunds (January 7).

LECTURER IN GEOGRAPHY in the Portsmouth Municipal College—The Registrar.

## Reports and other Publications

*(not included in the monthly Books Supplement)*

### Great Britain and Ireland

Transactions of the Royal Society of Edinburgh. Vol. 59, Part 3, No. 20: Studies on Plumage in the Male Brown Leghorn Fowl. By Dr. J. P. Chu. Pp. 533–562+5 plates. (Edinburgh: Robert Grant and Son, Ltd.; London: Williams and Norgate, Ltd.) 7s. [2311

Board of Trade. Statistical Abstract for the British Empire for each of the Ten Years 1928 to 1937. (Cmd. 5872.) Pp. xviii+337. (London: H.M. Stationery Office.) 5s. net. [2311

University of Liverpool: Social Science Department, Statistics Division. Handbook of Social Statistics relating to Merseyside. Pp. 32. (Liverpool: University Press of Liverpool.) 1s. net. [2311

Association of Bird Watchers and Wardens. Report of the Nest Adoption Scheme for 1938. Pp. 4. (Haslemere: Educational Museum.) [2411

Universities Bureau of the British Empire. Report of the Executive Council together with the Accounts of the Bureau for the Year 1st August 1937 to 31st July 1938. Pp. 26. (London: Universities Bureau of the British Empire.) [2411

British Empire Cancer Campaign. Fifteenth Annual Report of the Grand Council. Edited by J. P. Lockhart-Mummery. Pp. viii+270. (London: British Empire Cancer Campaign.) [2511

Ministry of Agriculture and Fisheries: Fisheries—England and Wales. Salmon and Freshwater Fisheries: Report for the Year 1937. Pp. 59. (London: H.M. Stationery Office.) 1s. 6d. net. [2811

The Teaching of General Science. Part 2. Science Masters' Association Final Report of the Sub-Committee appointed in 1935, adopted by the General Committee in 1938. Pp. vii+79. (London: John Murray,) 2s. 6d. [2911

Forestry Commission. Report of the National Forest Park Committee (Forest of Dean), 1938. Pp. 9+1 map. (London: H.M. Stationery Office.) 6d. net. [2911

British Rubber Publicity Association. Rubber and Agriculture Series, Bulletin No. 8: The Uses and Possibilities of Rubber in Agriculture. By Alexander Hay. Pp. ii+25. (London: British Rubber Publicity Association.) Free. [3011

Medical Research Council. Special Report Series, No. 231: Report on Radium Beam Therapy Research, 1934–1937. By Constance A. P. Wood, L. G. Grimmett, T. A. Green and others. Pp. 77+22 plates. (London: H.M. Stationery Office.) 4s. net. [3011

### Other Countries

Report of the Forest Department of British Honduras for the Year 1937. Pp. 16. (Belize: Government Printer.) [2411

The Aims, Methods and Activity of the League of Nations. Revised edition. Pp. 221. (Geneva: League of Nations; London: George Allen and Unwin, Ltd.) 2s. [2411

Osiris. Vol. 5. Pp. 601. (Bruges: St. Catherine Press, Ltd.) [2511

Statens Meteorologisk-Hydrografiska Anstalt. Meddelanden. Band 7, No. 4: Yttemperaturen i Svenska Vattendrag. Av Ragnar Melin. Pp. 17. 1.50 kr. Meddelanden, Serien Uppsatser. No. 22: Hydrometer-Beschreibungen. Von Tor Bergeron. Pp. 24. Meddelanden, Serien Uppsatser. No. 25: Hydrologisk Bibliografi, år 1937. Pp. 13. (Stockholm: Statens Meteorologisk-Hydrografiska Anstalt.) [2811

Annual Report of the Public Health Commissioner with the Government of India for 1936. Vol. 2. Pp. vi+135. (Delhi: Manager of Publications.) 1.10 rupees; 2s. 9d. [2811

Indian Central Cotton Committee: Technological Laboratory. Technological Bulletin, Series A, No. 44: Further Tests on the Combing of Good Quality Indian Cottons. By Dr. Nazir Ahmad. Pp. ii+25. (Bombay: Indian Central Cotton Committee.) 1 rupee. [2811

Coconut Research Scheme (Ceylon). Bulletin No. 2: Report on the Illuminating Powers of Lamps burning Coconut and Kerosene Oils. By Dr. J. P. Andrews, V. Appapillai and R. Subramaniam. [Pp. iv+17. (Lunuwila: Coconut Research Scheme.) 2811

Geological Survey of Uganda. Memoir No. 4: Soil Erosion and Water Supplies in Uganda. By E. J. Wayland and N. V. Brasnett; with Appendices on Water Supply, by C. B. Bisset, and on Soils and Soil Erosion in Karamoja, by Dr. W. S. Martin. Pp. iv+89+6 plates. (Entebbe: Government Printer.) 7s. 6d. [2811

Journal of the Indian Institute of Science. Vol. 21A, Part 25: Hydrogenation of Oils by the Continuous Process. Part 3: Isomerisation of Ethyl Oleate by Nickel Carbonate—Kieselguhr Catalyst. By V. T. Athavale and S. K. K. Jatkar. Pp. 295–306. 1 rupee. Vol. 21A, Part 26: Hydrogenation of Oils by the Continuous Process. Part 4: Kinetics of the Hydrogenation of Groundnut Oil by Precipitated Nickel Catalysts. By V. T. Athavale and S. K. K. Jatkar. Pp. 307–320. 1 rupee. (Bangalore: Indian Institute of Science.) [2811

League of Nations: Advisory Committee on Social Questions. The Recreational Cinema and the Young. (Official No.: C.256.M.152. 1938.IV.) Pp. 31. (Geneva: League of Nations; London: George Allen and Unwin, Ltd.) 9d. [2811

U.S. Department of the Interior: Geological Survey, Bulletin 885: Geology and Ore Deposits of the Lordsburg Mining District, Hidalgo County, New Mexico. By Samuel G. Lasky. Pp. v+62+25 plates. 1.25 dollars. Bulletin 891: Geology and Mineral Resources of the Honeybrook and Phœnixville Quadrangles, Pennsylvania. By F. Bascom and G. W. Stose. Pp. v+145+11 plates. 65 cents. Bulletin 895-D: Geophysical Abstracts 91, October–December 1937. Compiled by W. Ayvazoglou. Pp. ii+137–204. 15 cents. Professional Paper 189-B: Igneous Geology and Structure of the Mount Taylor Volcanic Field, New Mexico. By Charles B. Hunt. (Shorter Contributions to General Geology, 1937.) Pp. iv+51–80+plates 7–19. 45 cents. Water-Supply Paper 831: Surface Water Supply of the United States, 1937. Part 11: Pacific Slope Basins in California. Pp. vii+358. 45 cents. (Washington, D.C.: Government Printing Office.) [2811